MANAGEMENT OF EXTREME SITUATIONS

FROM POLAR EXPEDITIONS TO EXPLORATION-ORIENTED ORGANIZATIONS

PASCAL LIÈVRE, MONIQUE AUBRY AND GILLES GAREL

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Management of Extreme Situations

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From Polar Expeditions to Exploration-oriented Organizations

Edited by

Pascal Lièvre
Monique Aubry
Gilles Garel

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Preface

CERISY

The *Centre Culturel International de Cerisy* proposes, each year from the end of May to early October and within the welcoming context of a 17th-Century castle, an historic monument, meetings to bring together artists, researchers, teachers, students, social and economical actors, as well as the wider public interested in cultural and scientific exchanges.

A long cultural tradition

– Between 1910 and 1939, Paul Desjardins organized the famous "decades" in Pontigny abbey, to unite eminent personalities for debates on literary, social and political themes.

– In 1952, Anne Heurgon-Desjardins, while repairing the castle, created the *Centre Culturel* and continued, with her own personal touch, the work of her father.

– From 1977 to 2006, her daughters, Catherine Peyrou and Edith Heurgon, took the lead and brought a new dimension to the activities.

– Today, after the departure of Catherine and then of Jacques Peyrou, Cerisy continues under the management of Edith Heurgon and Dominique Peyrou, supported by Anne Peyrou-Bas and Christian Peyrou, also part of Cerisy castle's Civil Society, as well as with the support of an efficient and dedicated team led by Philippe Kister.

A like-minded original project

– They receive, in a prestigious setting far removed from urban disturbances and for a relatively long time period, people who are animated by the same attraction for discussion, in order to, through communal contemplation, invent new ideas and weave lasting connections.

– The Civil Society graciously puts the premises at the disposal of the *Association des Amis de Pontigny-Cerisy*, with no lucrative purpose and recognized for its public interest, currently presided over by Jean-Baptiste de Foucauld, the inspector general of finances.

A regularly supported action

– The *Centre Culturel*, the main means of action of the Association, has organized nearly *750 symposiums* broaching, through completely independent routes, the most diverse of themes. These symposiums have given rise, through various editors, to the publication of approximately *550 books*.

– The *Centre National du Livre* ensures continuous support to the organization and publication of the symposiums. The *territorial collectivities* (Normandy Region, department Council of the Manche, Coutances Mer and Bocage) and the *regional directorate of cultural affairs* bring their support to the Center, which also organizes, alongside the *Universities of Caen* and *Rennes 2*, encounters on themes concerning Normandy and the Great West.

– A *Cercle des Partenaires*, circle of partners, formed of enterprises, local collectives and public bodies, supports and even initiates *prospective* encounters on the main *contemporary challenges*.

Since 2012, a new modern and accessible conference room has allowed for a new formula: the “Entretiens de la Laiterie”, days for exchanges and debates, a collaborative effort from the partners of the Association.

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CCIC, Le Château, 50210 Cerisy-la-Salle, France
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Cerisy Symposiums

Selection of Publications

CERISY

L'Activité marchande sans le marché ?, Presses des Mines, 2010.

Le symbolique et le social (Pierre Bourdieu), Université de Liège, 2005, republication 2017.

Civilisations mondialisées : de l'éthologie à la prospective, L'Aube, 2004.

Communiquer/transmettre (autour de Régis Debray), Gallimard, 2001.

Les nouveaux régimes de la conception, Vuibert, republication, Hermann, 2014.

Connaissance, activité, organisation, La Découverte, 2005.

Déterminismes et complexités (autour d'Henri Atlan), La Découverte, 2008.

Le Développement durable, c'est enfin du bonheur !, L'Aube, 2005.

L'Économie de la connaissance et ses territoires, Hermann, 2010.

L'Économie des services pour un développement durable, L'Harmattan, 2007.

L'Entreprise, point aveugle du savoir, Éditions Sciences humaines, 2014.

Europe en mouvement – 1. À la croisée des cultures, Hermann, 2018.

L'Homme des sciences de l'homme, Presses universitaires de Paris Ouest, 2013.

Imaginaire, industrie et innovation, Manucius, 2016.

Individualismes contemporains et individualités, PU de Rennes, 2010.

L'Industrie, notre avenir, Eyrolles, 2015.

Intelligence de la complexité, L'Aube, republication, Hermann, 2013.

Renouveau des jardins : clés pour un monde durable?, Hermann, 2014.

Nourritures jardinières dans les sociétés urbanisées, Hermann, 2016.

Jardins en politique avec Gilles Clément, Hermann, 2018.

La Jeunesse n'est plus ce qu'elle était, PU de Rennes, 2010.

Des possibles de la pensée (itinéraire philosophique de F. Jullien), Hermann, 2014.

Ce que la Misère nous donne à repenser, avec Joseph Wresinski, Hermann, 2018.

Penser la Négociation aujourd'hui, De Boeck, 2009.

S'orienter dans un monde en mouvement, L'Harmattan, 2018.

De Pontigny à Cerisy: des lieux pour « penser avec ensemble », Hermann, 2011.

La philosophie déplacée : autour de Jacques Rancière, Horlieu, 2006.

Prendre soin : savoirs, pratiques, nouvelles perspectives, Hermann, 2013.

Du Risque à la menace. Penser la catastrophe, PUF, 2013.

Sciences de la vie, sciences de l'information, ISTE Editions, 2017.

Des sciences sociales à la science sociale, Le Bord de l'eau, 2018.

La Sérendipité. Le hasard heureux, Hermann, 2011.

Gilbert Simondon et l'invention du futur, Klincksieck, 2016.

Lectures contemporaines de Spinoza, Presses universitaires Paris Sorbonne, 2012.

L'empreinte de la technique. Ethnotechnologie prospective, L'Harmattan, 2010.

Qu'est-ce qu'un régime de travail réellement humain, Hermann, 2018.

Universités populaires, hier et aujourd'hui, Autrement, 2012.

Villes, territoires, réversibilités, Hermann, 2013.

Le moment du vivant, PUF, 2016.

Introduction

The purpose of this book, edited by Pascal Lièvre (CRCGM, UCA), Monique Aubry (ESG-UQAM) and Gilles Garel (CNAM), is to report on the Cerisy symposium held from June 14 to June 21, 2016, entitled "*Management des situations extrêmes : des expéditions polaires aux organisations orientées exploration*"[1]. This symposium was supported by Lirsa, CRCGM and Open Lab Exploration Innovation and took place in the always magical setting of the Château de Cerisy La Salle, in a rainy, studious, dense, continuous and friendly atmosphere. Calva and champagne punctuated our academic debates but also our evenings, which were based in a more sensitive register around testimonies/experiences concerning, for instance, the emergence of a new technology in the Himalayas or an identity itinerary of a sea kayaker in the Arctic. It brought together 52 participants. We would like to thank Edith Heurgon for her warm and firm welcome in this collective adventure and to the entire team for their logistical assistance at all times. A very special thought is expressed for Catherine de Condillac who has since moved to other heavens.

In this introduction, we propose first to recall the intention of the symposium and to report on the debates that took place, then to come back to some theoretical definitions and frameworks of the management of extreme situations program, and finally to present the outline of the book, which is an *ex post* rationalization of our work.

I.1. Intent and status of the debates

We set out in the following way the arguments that would form the basis of our reflections. Managers are often confronted with extreme management situations

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Introduction written by Pascal LIÈVRE.

1 Management of extreme situations: from polar expeditions to exploration-oriented organizations.

when they face collective action that takes the form of a project, intensive in terms of knowledge, in an evolving, uncertain and risky context. These situations may be intentional or non-intentional, but emergency and/or crisis situations also arise. In all cases, they are the subjects of a specific form of management where organizational creativity and reliability are combined. This conference therefore provided an opportunity to review the principles and mechanisms for managing these situations by exploring different types of terrain: from polar expeditions to innovative disruption approaches and fire rescue services. Research highlights three areas that increase the intelligibility of these situations: the construction of meaning within collectives, organizational ambidextrous capacities and systems for expanding experiential and scientific knowledge. *In fine*, the management of extreme situations appears to involve the management of disruptions that require "situated" learning, the source of which is creative human potential.

This conference was an opportunity to re-question definitions that were taken for granted around the management of extreme situations. First of all, different categories of the extreme have emerged with possibilities of articulation between them: extreme achievement, extreme innovation, extreme urgency, extreme crisis, etc. Extreme situations have been described as "new" but also as the daily prize of managers in the context of a knowledge economy. They have also appeared as "banal" and "old" in the context of wars, storms and diseases but also in the field of maritime, polar, high altitude and space exploration. The extreme management situation has been characterized as both an objective and subjective disruption with a more familiar past situation, moving toward a situation where the radically unpredictable new situation cannot be ruled out and where actions are never trivial, as they can have serious economic, organizational, vital or symbolic consequences. Finally, management has had very different attitudes toward the extreme: it first wanted to eliminate it, then face it and today it wants to generate it through disruptive innovation.

The debates revealed both differences and possible articulations between different ways of investing in this object on a theoretical level: in terms of a management "device" and an action plan in the sense of Hatchuel, in terms of "practice" in the sense of Bourdieu to move toward the notion of a "management situation" in the sense of Girin (1990) or that of a "project as practice" (Blomquist *et al.* 2010) and finally from the perspective of a firm theory in the sense of Cohendet (Cohendet *et al.* 2017). In all cases, an investigation of practices appeared to be somehow unavoidable, raising questions that fall within the scope of anthropology.

The heuristics of extreme situations were discussed. The construction of meaning was addressed from a variety of perspectives, but also as a certain way of combining "sensemaking" and "meaning". Natural ambidexterity at the team level appeared as the first example compared to organizational ambidexterity.

The notions of "spark", "manifesto" and "community" have repeatedly been proposed as a chronological reading grid for knowledge expansion schemes. Other disciplines such as psychology have been invited into our exchanges on several occasions. Expeditions, whether polar or mountain expeditions, have found their full legitimacy in management sciences. We have also been able to show that it is possible to establish links between creativity and reliability within organizations. In the end, it is a question of learning in situations and its regulation that has emerged as a major issue in the management of extreme situations.

I.2. Some framework elements around the management of extreme situations

The starting point of this research program is the emergence of a knowledge economy in the 1990s (Drucker 1993; Nonaka and Takeuchi 1995; Hatchuel and Weil 2002; Foray 2003; Amin and Cohendet 2004) which is leading managers to face a new kind of *management situation* that we call *extreme*: management situations that are *at odds with* a usual way of doing things, with what we used to do before, and that will require actors *to acquire new knowledge* to cope with the situation. Management situations are the conditions where, as we will see later on, the unknown, scalability, radical uncertainty and risk become the elements with which managers must work. These management situations are a total disruption compared to what managers experienced during the 1950–1975 period, in an economy of production and mass consumption, and a smaller but still strong disruption with an economy of quality (1974–1990). But above all, this new economy is characterized by permanent change (Foray 2009), the era of permanent disruptions "the movement" as Alter (2002) calls it. The question of learning, adaptation and innovation is permanently raised as a matrix of the organization's performance (Nonaka 1994).

This is a new type of management situation that we are addressing in a more precise way, such as "the design and implementation of collective actions in the form of projects, intensive in terms of knowledge, in an evolving, uncertain and risky context" (Lièvre 2016). This type of extreme management situation also corresponds to what some authors such as Hatchuel, Garel and Lenfle call innovative exploration projects that are mainly characterized by the fact that objectives and means will emerge along the way (Lenfle 2008). At the same time, if these new management situations are largely unknown in the field of management, if they must be radically considered as enigmas according to Hatchuel's expression, we make the assumption that we can learn from ordinary scientists such as polar shippers**,** for example, who have faced this type of management situation for three centuries. On the one hand, as historians, we have taken an interest in the logbooks of many expeditions (Lièvre and Rix-Lièvre 2013), but we have also take an

interest, on the other hand, as anthropologists, in 10 expeditions from the idea to the return to France by building ethnographic devices capable of investing in the practices located (Lièvre and Rix-Lièvre 2009, 2014; Rix-Lièvre and Lièvre 2010, 2014).

This is why we have chosen in this book to present an exemplary polar expedition, Nansen's mission to explore the North Pole; to invest in the change of plan when the world's first mountaineering project was realized in Patagonia; to gather the testimony of a Himalayan in his approach to expedition innovation; a sea kayaker in the Arctic in terms of his identity and learning path; but also that of Michelin's training managers in charge of this new managerial approach: exploration.

By mobilizing this notion of management situation developed by Jacques Girin (1983), we borrow a particular problem from the management sciences. This is the process of empowerment in relation to the economic and social sciences. We focus on a particular research object, the *management situation*, in a clinical or engineering posture by mobilizing a resolutely interactionist theoretical framework in the sense of the Chicago school of thought, by investing in "situated" practices, and by focusing on the assembly of human and non-human actors constitutive of the performance of collective action.

Let us return more precisely to this notion of the management situation. We will take as a starting point the definition proposed by Girin as early as 1983: the management situation is *a collective activity linked to a result that is the subject of a judgment*, and where *agents are engaged when they recognize themselves as participating to varying degrees in the production of the result* (Girin 1983).

We can distinguish *different management situations* according to the *degree of freedom that the collective has* to engage in the situation but also according to the more or less routine nature of the situation. Two management situations can be opposed according to *their origin*: management is *constrained or intended* to express the degree of freedom that the collective has with regard to the situation.

We can also distinguish two types of management situations depending on *the nature of the collective activity*, which may be of a *routine* or *project-based nature* following the work of Declerk *et al.* (1983). A two-by-two combination between these four orientations is possible, which we can represent in the form of Table I.1.

Management situation	Exploitation	Exploration
Deliberate	To express the actor's degree of freedom with reference to the action and the existence of organizational routines to deal with the situation	To express the actor's degree of freedom with reference to the action and the lack of organizational routines to deal with the situation
Constrained	To express the actor's degree of constraint with reference to the action and the existence of organizational routines to deal with the situation	To express the actor's degree of constraintwith reference to the action and the lack of organizational routines to deal with the situation

Table I.1. *Typology of management situations according to the actors' degrees of freedom and the existence of organizational routines*

We must now clarify what makes a management situation extreme. It is considered *extreme* when it takes place in an *evolving, uncertain and risky* context (Lièvre 2005, 2016; Bouty *et al.* 2012). Let us clarify the different terms. An "extreme" situation is a *situation that evolves* over time. It appears to have a certain break with a previous operating mode (Rivolier 1998). There is, therefore, a gap between a previous and a current situation and/or a current situation and a future situation. This gap may be more or less wide. It is possible to identify stages in its development. There is a "before" and there is an "after". For example, there is the design stage, then the preparation stage and finally the implementation stage. This scalability will require monitoring, anticipation and flexibility.

In terms of the second notion, the context appears *uncertain for* the actors. We are dealing here with a *radical uncertainty of* situations in the sense of Knight (1921) where the probability of an event occurring is not measurable. A distinction must be made between radical uncertainty and the notion of risk. Behind the notion of risk is the prism of rational action, the consequences of which can be assessed in a probable way. In situations of extreme uncertainty, "we know that we don't know, but that's about all we know" (Callon *et al.* 2001, p. 40). We recognize that new things can emerge in the situation and that we cannot anticipate them. The new can appear (Orléan 1986) and the unpredictable is possible as Jean-Louis Le Moigne (1990) expresses it. This radical uncertainty cannot be treated in the preparation phase as an "exhaustive" list of probable situations that the team will encounter, but rather as an ability to adapt to unexpected situations and demonstrate resilience in the sense of Weick's (1993) work.

In terms of the third criterion, we are in the presence of a *risk situation*, i.e. a situation where the possibility that an undesirable event may occur cannot be ruled out and that it may cause more or less significant damage to the organization. We come from a classical risk perspective (Slovic 2000; Wybo 2004). But these risks are not always measurable. The risk may also be that the designated objective is not achieved and that this objective represents an "essential" issue for an actor or the collective. It is the presence of risk that tends to direct the behavior of actors toward "adapted" behavior because the sanction is "at the end" of the choices made and can be "serious" with consequences. Alternative scenarios will have to be developed based on the risks identified.

Finally, we can also better describe the extreme situation in terms of urgency, crisis, disaster, danger, hostility, vital or symbolic risk, or according to the environment... Extreme situations can also be emergency situations where the question of the temporality of decisions and actions takes on a very particular value (Lièvre and Gautier 2009). Roux-Dufort (2001) characterizes this situation as follows: "Urgency always arises from a twofold awareness: on the one hand, that an unavoidable part of reality is a scenario with dramatic or unacceptable consequences and, on the other hand, that only action of exceptional speed can prevent the scenario from leading to its conclusion". An extreme situation can also become a crisis situation as defined by Roux-Dufort (2001): when the accumulation of minor incidents gradually leads the actors to a situation that exceeds their competence. As Wybo (2004) points out, crisis situations can emerge when

> "incidents of external or internal origin affect the situation [and] people react first by identifying the new situation and applying procedures or plans, if any. If the situation goes beyond this framework, either because there is no appropriate procedure (the incident has not been considered and has never happened before), or because the planned defenses have not worked, then the organization enters a crisis. This is moving toward a management based on experience and innovation, in which the various actors will do their best to bring the system back to a known and stable state, while limiting damage and the extent of the accident."

If the consequences are very significant, we will speak of a disaster as outlined by Lagadec. There are situations involving vital (the risk of losing one's life) and/or symbolic (the risk of losing the final of the World Cup) risks, hostile situations such as war in the literal or figurative sense (economic war), situations taking place in extreme environments such as mountains, the sea, the poles... We can also distinguish dangerous situations when the danger is proven: the polar bear that attacks the polar explorers' camp because it is hungry. There is no consensus on these definitions. It is a work in progress. A recent summary of the literature on

extreme contexts has been produced by Hällgren *et al*. (2018) from about 100 articles published since 1980. The meta-analysis carried out makes it possible to distinguish three concepts: risk, urgency and disruption. It is by clarifying these different notions that the development of research in extreme contexts can be fully realized, such is the theory defended by the authors.

We can now better describe the new category of management situation that prevails today and that we want to study. *These are exploration management situations that take place in an extreme context*.

We approach the *question of managing the management situation*, in line with the notion of *organizational layout* developed by Girin (1990). Indeed, we take this collective action, which is intensive in terms of knowledge, as an *assemblage between human and non-human actors* in the sense of Latour's theory (2006), of which authorization and the authorization representative are part. Authorization, which may take the form of an order or a sponsor (a mandate holder) or an external event, and the authorized representative, which may take the form of a department or project manager, are part of the management situation. The controversies between the actors in the development of the situation express the dialogical nature of the action. They are mediation artifacts for the construction of new sociomaterial combinations that can develop collective action. We have begun to develop this type of approach to address both the understanding but also the management of an Arctic expedition (Garel and Lièvre 2010).

An extreme management situation must be considered fundamentally as a learning process for the actors involved in the situation as we already explained at the beginning of this introduction. Our investigations of the polar expeditions have identified three areas that will affect the nature and competence of the organizational arrangement: (a) the construction of meaning for the actors throughout the project, which conditions their ability to learn, adapt and improvise, (b) natural ambidexterity (Aubry and Lièvre 2010), the collective's ability to be involved as much in a planning logic as in an adaptation logic, in an exploitation logic as in an exploration logic and finally (c) the expansion of experimental and scientific knowledge that will allow "informed" decision-making for the project's progress (Lièvre 2016). Thus, being in control of an extreme management situation requires vigilance of the organizational arrangement from the point of view of these three categories. This arrangement must *above all* facilitate actors' learning *in the situation* and is part of what is called situated learning (Lave and Wenger 1991; Wenger 1998). We have shown how the organizational arrangement of an exploration project can take the form, on the one hand, of a learning community as described by Wenger (Bonnet *et al.* 2017). We are interested in vigilance with regard to the construction of meaning as part of a support system for an exploration project. This takes the form of a PSDR, a research-action program implemented in

French regions by INRA (Lardon *et al.* 2017). The identification, appropriation and mobilization of controversies between stakeholders throughout the project allowed the construction of new sociomaterial combinations that allowed significant progress to be made in the project. We hypothesize that controversies are the expression of actors' expectations, revealing differentiated sensitivities in relation to their vital aspirations, resulting from their biographical trajectories (Recopé *et al.* 2003).

Gilles Garel and Monique Aubry played a special role in the development of this research program. Gilles Garel showed how a polar expedition was indeed a project as discussed by Midler with particularities such as the fact that it is the same actors who design and implement the project, anticipating one of the keys to concurrent engineering. He thus legitimized the relevance of taking the polar expedition as a research subject within the management sciences (Garel and Lièvre 2010). Monique Aubry made a wager that the polar expedition could be a matrix to reflect on a new way of approaching the project. It would be more adapted to the complexity of the problems facing organizations. The plan can no longer be considered as the progress of the project, but rather as a resource that contributes to the emergence of the project throughout its lifetime (Aubry and Lièvre 2010). This approach to planning in projects is a profound challenge to the rationality of collective action as expressed in most norms and standards in project management.

I.3. Presentation of the book

The book is structured in four parts. The first part proposes to invest in the question of the extreme and exploration around three chapters. Section 1 is devoted to the logic of exploration based on a theoretical perspective of two emblematic projects: Nansen's expedition to the North Pole at the end of the 19th Century, proposed by Pascal Lièvre, and the Manhattan project during the Second World War, which led to the manufacture of the first atomic bomb, analyzed by Sylvain Lenfle. Section 2 is devoted to two testimonies on this question of exploration: the Michelin Group, written by Bruno Stévenin and Éric Dépraetere, explains the construction methods but also the ingredients of a training program to make managers aware of the change of register that is exploration in relation to exploitation; and Paulo Grobel, a high mountain guide and a great specialist in the Himalayas, reports on his progress in inventing a new progression technique to study the world's highest mountains: gentle progression. In Section 3, the question of the empirical investigation of the extreme for the researcher is raised. Mondher Kilani recalls how extreme investigations have disrupted the epistemology of anthropology by orienting it toward the question of involvement and reflexivity. Geraldine Rix-Lièvre proposes epistemological and methodological benchmarks to discuss practices from an extreme perspective with the help of video-ethnography.

In the second part, it is the organizational performance of extreme situations that is analyzed from two angles: creativity and reliability**.** With regard to organizational creativity, Patrick Cohendet and Laurent Simon show how a large video game company faces a crisis of creativity by inventing in a new organizational routine. Gilles Garel explains the governance invented by Creaholic that helped it remain a company exclusively oriented toward exploration for 20 years. Guy Parmentier offers an overview of the literature in management sciences on the issue of creativity under constraint. Finally, Todd Lubart and Samira Bourgeois-Bougrine discuss the links between creativity and extreme situations, from the point of view of psychology in a contribution entitled "Creativity for Extreme Situations". But another facet of organizational performance in extreme situations is reliability. Benoît Journé revisits the notion of extreme situations and explains under what conditions an articulation between work on extreme situations and highly reliable organizations is possible. Anaïs Gautier aims to pinpoint errors in decision-making within fire rescue organizations.

In the third part, the three registers of intelligibility of extreme situations that we have pointed out in the introduction are discussed: construction of meaning, natural ambidexterity and expansion of knowledge are the subject of three separate chapters, respectively. On the question of the construction of meaning, Jean Pierre Boutinet explores the variety of "meaning" at the very heart of the project activity, while Michel Récopé develops the links between meaning, sensitivity and competence of actors in extreme situations. Finally, Pascal Croset proposes to report on his sensitive itinerary when learning of a new identity: the kayaker in the Arctic. On the issue of natural ambidexterity, Monique Aubry reports on her journey to discover the different modes of action that combine and articulate in extreme projects and shows the relevance of this type of analysis through a case study in the health field. Geneviève Musca in collaboration with Caroline Mellet, Gilda Simoni, Frédérique Sitri, Sarah de Vogüé and Linda Rouleau reports on the complexity of the question of changing the plan during an exploration expedition in Patagonia, the first attempt to cross the Darwin mountain range. Finally, the process of knowledge expansion is addressed in different ways. Jean-Louis Ermine and Pierre Saulais show how the heritage of knowledge can be mobilized to create new knowledge to produce disruption innovation at Thales Air. Jean-Philippe Bootz and Olivier Dupouët point out the role that communities of practice can play in coping with change in extreme situations in order to produce adapted knowledge. Marc Lecoutre proposes to provide answers on how to solicit experts, who have the critical knowledge for the development of a project in an extreme environment, by mobilizing the corpus of social network theory. Claude Guittard and Éric Schenk are interested in the crowd as an entity capable of producing highly relevant knowledge in response to different types of problems identified.

The fourth part shows the wide variety of extreme situations based on the PhD research conducted in the extreme situation management program reported by Emmanuel Bonnet, Christelle Baron, Stéphane Cellier-Courtil, Nicolas Laroche and Isabelle Magne. David Massé shows how the artistic sector is indeed part of the exploration field based on an investigation of the training of artists at Cirque du Soleil, game designers at Ubisoft and horsemen at the *Académie du spectacle équestre de Versailles*. There are a wide variety of extreme situations that must be nourished by a fruitful dialogue between management sciences and psychology. Jean-Claude Coulet shows the perspectives that developmental psychology and the psychology of learning offers to address activity in extreme situations, and Linda Rouleau outlines the academic admissibility of research in extreme contexts in major management science journals.

Finally, it is through a three-part conclusion that Gilles Garel, Monique Aubry and Pascal Lièvre, respectively, propose some elements for summarizing the debates that took place during the week at Cerisy and draw some perspectives on future research.

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PART 1

Exploration and the Extreme

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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SECTION 1

The Logic of Exploration

1

An Exemplary Exploration Story: Nansen's Expedition to the North Pole

1.1. Introduction

The purpose of this contribution is to discuss an emblematic project in the field of polar expeditions. The project falls within the category of "extreme exploration situations" in order to document the profound nature of the organizational performance of this type of collective action. On a theoretical level, we are in the wake of radical innovation project management that conditions the development of this type of project to a process of knowledge expansion (Nonaka 1994; Midler 1996; Hatchuel *et al.* 2005; Lenfle 2008; Cohendet and Simon 2007). We approach this question of knowledge expansion from the perspective of a cognitive dynamic of learning (Wenger 1998; Nooteboom 2008), which is a necessary condition for any development of this type of project. From an empirical investigation of about 10 polar expeditions, we were able to identify three registers that must be the subject of vigilance for a project manager in responsibility: the construction of meaning, the capacity for organizational ambidexterity and the expansion of experiential and scientific knowledge (Lièvre 2016). Different combinations are possible between these three registers that build different organizational agencies, in the sense of Girin's work (1995), that affect the performance of collective action.

We chose one of the greatest achievements in polar history, the Norwegian Fridtjof Nansen's expedition to the North Pole in 1893. This expedition has all the attributes of exploration projects in terms of the unknown, scalability, uncertainty and risk and at a level of intensity that makes this project quite interesting from a scientific point of view due to its radical nature.

Chapter written by Pascal LIÈVRE.

There are some elements that can measure the project. At the time, the North Pole was a real unknown place. Scientific controversies were intense and numerous on the subject. For example, the German geographer Auguste Peterman (1850) defended the theory of the Open Polar Sea, under the influence of the warm currents of the Gulf Stream, documented by the observations of Kane's expedition (1853) that contrasted with the theory of the Norwegian meteorologist Henrik Mohn (1884) who defended the existence of an ice cap covered by glacial currents. Vital risk was omnipresent in this type of adventure where boats were crushed by ice and there were few survivors. As geographer Marie-Françoise Andrée (2001) has explained, this period of falling temperatures known as the "Little Ice Age" had paradoxically been the golden age of polar exploration fuelled by the quest for the Arctic. In fact, it was a formidable time for polar shippers with dramatic consequences: for example, the Franklin expedition disaster in search of the Northwest Passage (1855) (two ships and 120 crewmen missing), no less than five shipwrecks from the seven ships sent in search of Franklin, and finally the sinking of HSS Jeannette (1881), an American expedition going to the North Pole. In this context, Nansen's expedition already appeared to be an achievement. Indeed, all sailors returned safe and sound. The boat returned safely to port, after voluntarily letting itself be caught in the ice. Indeed, the project was extremely daring since it involved going up the coast of Siberia by taking advantage of the warm Gulf Stream current, getting caught in the ice and taking advantage of the glacial currents to let itself be carried to the North Pole, then to the open waters of Spitzberg and back to Norway. The North Pole was not reached but the expedition reached the northernmost point of the time (86°14' LN).

A few months after the expedition, Nansen published his logbook. This book was translated very quickly into many languages and is the bedside reading of many generations of polar shippers to this day. It was from this knowledge base that the North Pole was reached by two Americans, Cook in 1908 and Peary in 1909. We see above all the creation of a Norwegian school for polar expeditions (Sverdrup, Amundsen), in contrast to an English school (Franklin, Scott, Shackleton) which was based on the principles of maritime exploration developed by James Cook. This Norwegian school had two major world successes with Amundsen: the first crossing of the NW Passage (1906) and the conquest of the South Pole (1911), while the English school experienced disasters and failures. The South Pole became the subject of a radical confrontation, at the same time, between these two modes of exploration, with the Norwegian explorer Amundsen, on the one hand, and the English explorer Scott, on the other hand. We know the unfortunate outcome of this English expedition that ended near a depot of life that could not be reached, while the Norwegian flag was flying at the South Pole. Explorers like Paul Emile Victor in the 1950s, and even Jean Louis Etienne in France and Borge Ousland in Norway, consider Nansen's expedition as an irreplaceable reference.

We simply propose to illustrate from this expedition how the three registers we have identified are positively affected and contribute to the organizational performance of this type of project.

The first register to follow in order to understand the relevance of the organizational arrangement of this expedition is that of the construction of meaning for all the actors throughout the progress of this project. We will focus only on Nansen, the conductor of this expedition.

1.2. A project that makes "sense" because it is consistent with an identity-based learning trajectory

We consider *the construction of meaning for actors in situations* as a prerequisite for any capacity for learning, adaptation and creativity in line with Weick's (2001) work. But ontologically, it is not a strictly discursive and/or semantic register, but rather a relational ontology (enactive) as discussed by Varela (1996), a singular form of interaction between each actor and their environment, an *adaptive embodied sensitivity* where emotion–cognition–motor function are linked, which refers to what Récopé (2018, see Chapter 9 of this book) calls a phenomenology of activity, finely articulating authors like Varela, Canguilhem, and Merleau-Ponty. This question of meaning as it is expressed in actions and situations, *in vivo*, refers to the actor's own norms in reference to a world of value that is expressed in polar oppositions between a positive and a negative (Canguilhem 1966), structured and structuring unconscious dispositions to act that orient toward a style of practice (Bourdieu 1994). But this sensitivity can also be expressed at a given moment in the context of a discursive activity and it is also related to semantic fields. This sensitivity is created during the life history of individuals in an identity-based learning trajectory (Wenger-Trayner *et al.* 2014).

In the field of polar ski expeditions, it is the investigation of practices that have appeared both highly differentiated and highly structured that has led us to focus on the explorers' own standards (Lièvre *et al.* 2003). We have been led to distinguish, on the one hand, "explorer beings" for whom the expedition is first in relation to their life, which will result in their being strongly affected by the situations, and "beings" who simply carry out explorations in a secondary way. The latter are in fact less affected by the situations. Beyond this question of commitment, on the other hand, different styles of practice appear in terms of sensitivity and value that express an orientation when organizing the exploration that takes the form of a quality convention and guides each operation of the exploration. We were able to identify four major sensitivities that express an orientation in the exploration: toward progression techniques such as the pleasure of skiing, toward the achievement of a sporting feat, toward the exploration and discovery of an unknown environment and

toward science or ecological activism (Lièvre *et al.* 2003, 2018). We were able to create a polar map of these sensitivities that express distances and proximities between them, but also multiple possibilities of combination.

Nansen's expedition is part of an identity-based learning trajectory of a polar expeditionary being developing a sensitivity to the interface between exploration and science. Nansen's sensitivity is built into his life story.

We propose to highlight some key events in Nansen's life story, which show the great coherence between the project of this expedition to the North Pole and Nansen's identity aspirations.

Fridtjof Nansen was born on October 21, 1861, in the near suburbs of Christiana (Oslo in 1905) in Norway. He came from a wealthy family; his father was a lawyer. From an early age, he developed a passion for outdoor activities in the mountains and on the sea. The main activities in the summer were swimming and fishing, while in the fall, the main hobby was hunting in the forest. Winters in Norway are mainly devoted to skiing, which Nansen practiced from the age of two. He would later become a ski champion in his own country. Also, it is on skis in winter that he hunted reindeer and moose in the wilderness (Ballut 1996). He was also not afraid to go alone, or with a few friends, with the minimum, to camp out in the snow. Sensitivity to the exploration of the natural environment was demonstrated here.

He studied zoology at the University of Christiana, thinking that it would allow him to have an outdoor occupation. In fact, at the age of 21, he took advantage of a 5-month maritime seal and whale hunting expedition to study Arctic zoology. The ship remained trapped in ice for 24 days on the east coast of Greenland. He had all the time in the world to meditate on this unknown land. It was there that he wished to reach, on foot via the ice floe, the eastern coast of this large island and to cross it. Upon his return, he wrote an article to this effect in the Bulletin of the Royal Geographical Society of Copenhagen. This expedition, Nansen confided, was a "fatal experience that led me astray from the quiet life of science". In any case, studies were second only to sport or expeditions to the forests where he lived "like Robinson Crusoe" (Huntford 1997, pp. 18–19; Scott 1971, pp. 11–12). Upon his return, he accepted a position as curator in the zoology department of the Bergen Museum in 1882. He carried out various studies on the nervous system of marine animals, which became the subject of a thesis in 1887. Just after the defense, he embarked on this adventure of crossing the Greenland ice cap. In 1888, he and six teammates crossed the Greenland ice cap on skis in less than 2 months.

On his return from Greenland, he married on September 6, 1889, and at the same time prepared to go on an expedition to the North Pole a few years later in 1893. We see here how Nansen considered expeditions as a vital necessity and therefore first

in relation to his emotional and professional life. On the day of his departure, he declared: “I leave behind me what I hold dearest in the world” (Nansen 1996b, p. 29). This was his wife and his granddaughter Liv, who was 3 years old at the time. He set out on his 3- to 5-year expedition.

The expedition had an exceptional resonance among society. Nansen received thousands of applications and he therefore chose a group of 12 people, including Otto Sverdrup who had gone with him to Greenland. The latter was appointed captain of the Fram and second in command of the expedition. The competition for available places was such that the army reserve lieutenant and musher expert Hjalmar Johansen signed up as the ship’s stoker.

This expedition to the North Pole was a real achievement for Nansen that he approached with great serenity and a sense of satisfaction. This expedition made sense to him both in terms of the intention of the project and the way it was conducted. It enabled exceptional capacities for learning, adaptation and innovation to be developed.

An extract from his logbook, while the boat was frozen in ice, is particularly illustrative of Nansen’s state of mind and the nature of the pleasure he experienced on this expedition. November 13, 1893, –39 °C:

> “A skating race (on skis) by a beautiful moonlight. No, in truth, our life is not a constant suffering as we must believe it is. For example, is it a painful ordeal to slide fast like an arrow on the ice, endlessly, in the cold under a sky dotted with stars. All around us lies the slick of the silver ice floe by the moonlight (...). Very low in the south, a reddish glow emerges, higher yellow, then green, blending seamlessly into the huge blue dome. An indescribable harmony that music alone could translate. It is more than it is allowed to expect from life (...). And when you come back when you sit in the peaceful workroom, with your feet by the fire, your pipe lit, and you stay there lost in reverie, is that suffering?” (Nansen 1996b, p. 112)

1.3. A radical dual ambidextrous capacity

Based on the investigation of two highly contrasting polar expeditions, one in the Arctic, on skis, rather informal and modest in terms of the team’s size, budget and objective, and another in Antarctica, on boats, rather structured and ambitious, with sponsors and media coverage, we have shown that the performance of these two expeditions led by experts is conditioned by the fact of a dual organizational ambidexterity or more precisely a natural ambidexterity (Aubry and Lièvre 2010).

For the team in charge of the project, this competence translated into an ability to plan as much as to question the plan in the situation if necessary (Mintzberg 1996) and an ability to invent as much as to mobilize existing skills (March 1991; Aubry 2018, see Chapter 16 of this book).

1.3.1. *Planning*

The prototyping of the expedition (Lenfle 2008) was carried out on the one hand from the time scale of the wreckage of the Jeannette between the islands of New Siberia and southern Greenland, i.e. three years, and, on the other hand, from the facts of building a boat that is able to withstand ice pressure. Between the idea and the start of the expedition, 9 years was required.

The first thing to plan was the construction of a boat with specific qualities since it was important if caught in the sea ice to not to be crushed and then to be able to go back to the open sea. A ship that was as small, short, yet wide as possible was needed to provide a solid and comfortable refuge during drift across the ocean. The Fram was therefore constructed (39 m long, 11 m wide), a steamboat, built by a specialist in the field, the Norwegian engineer Colin Archer.

Food was also the subject of great attention:

> "In order to avoid scurvy, I took great care of the supplies and chose them to provide us with healthy and varied food. Before being adopted by the shipment, each item was subjected to chemical analysis. The packaging was also carefully cared for; even the dried vegetables and biscuits were enclosed in zinc boxes. Is it not indeed useless to carry a considerable quantity of food, if the most meticulous precautions are not taken to ensure conservation? The slightest negligence can have the most terrible consequences". (Nansen 1996b, p. 25)

Note that 12 team members were rigorously selected according to their respective experiences and motivations. It was Nansen's companion on the Greenland crossing, Otto Sverdrup, who became captain of the Fram. He chose the most resistant Siberian dogs to pull the sleds that were bought locally during the first part of the trip.

The expedition was planned for a period of more than three years. But in view of the uncertainty, Nansen scheduled in five years of provisions and eight years of fuel. Three years were devoted solely to its organization.

Nansen also anticipated what life would be like on a boat caught in the ice. Various activities were organized (music, reading, games) including some on the ice floe (hunting, fishing, skiing, etc.) to maintain the morale of the troops.

Finally, scenarios for returning in the event of the boat being crushed by ice were projected: skis, dogs, sleds, canoes, etc. Thus, he also equipped himself for sleigh expeditions on the ice floe (fur clothing, tents, skis, alcohol stoves, a sextant, etc.). In addition, Nansen planned bases to live in Siberia.

1.3.2. *Adaptation*

The boat's drift was following the ice currents but much less toward the North Pole than expected. A serious mistake, said Nansen, diverted them from the expedition's objective. January 14, 1894:

> "A good step towards the North. Yesterday we were at 79°19' North latitude and 137°31' East longitude. During the day, I make a long excursion on foot. The ice is compact, excellent for dragging; as I move forward, it gets flatter and flatter. The more I look at this ice floe, the more mature in my head is a project that I have often thought about for a long time. On such ice, it would be possible to reach the pole with sleds and dogs, allowing the ship to continue on its way to Franz Josef Land, Spitsbergen or Greenland. It would be an easy undertaking for two men. In any case, it would be premature to leave next spring. First I need to know the results of the drift during the summer. Second, is it right to abandon others? Imagine I get back to Norway and my companions perish with the Fram!" (Nansen 1996b, p. 75)

Nansen decided to go on the ice floe with dogs and a sled to try to reach the North Pole, with only one of his companions. The return trip had to be made by kayaks to Spitsbergen.

The expedition was meticulously prepared for several months, but it would take three departures for Nansen to undertake this new expedition. Indeed, each time, there was an adaptation to improve the chances of project success. A departure occurred on February 24, but the sleds appeared too heavily loaded and too fragile. They had to return to the Fram. Repair, reinforcement of the sled and lightening of the equipment took place. A start was made again on February 28, but progress was still too slow and the dogs suffered from the previous night's cold weather. Nansen returned to the boat to lighten the luggage and wait for the temperature to rise. He improved the sleds and made the decision to leave some equipment. The temperature was getting warmer. Finally, they departed on March 14.

In view of the daily progress of the expedition, Nansen realized that the North Pole would be inaccessible because spring was approaching. They had to quickly turn around to have a chance to return to dry land.

This ability to change plan, as Markus Hallgreen (2007) calls it, the management of deviations based on case studies in high mountains, is a distinctive feature on the managerial level of extreme management situations.

1.3.3. *Exploration*

This idea of letting the boat get caught in the ice and following the ice currents was a complete break with all the expedition strategies of the time. It was a radical innovation that had never been attempted before to reach the North Pole, and more broadly in polar history. When his project was presented to the Norwegian Geographical Society in 1890, the experts of the time were extremely critical, proving the radically innovative nature of this project: “It is illogical and close to self-destruction... It takes these men to their deaths... The boat can never resist... It is a completely crazy idea...”. It was also the first time that a boat would be built that must withstand the pressure of the ice. Nansen writes: “The ship had surfaces everywhere that were united so that it could slide like an eel out of the ice when the blocks tightened tightly around it” (Nansen 1996b, p. 21). The ends were reinforced with the propellers and rudder removable in 1 h time. The sides were as strong as possible and the walls were 80 cm thick. All parts were connected to each other by the inside of the vessel so that the assembly formed a single mass. The engine had several cylinders each capable of operating in isolation. The cabins were insulated against cold and humidity. The hold was divided into three watertight compartments. Electricity was obtained with a dynamo when the boat was en route and also from a stationary windmill.

This attempt to ski together independently to and from the North Pole was also a world first! And finally, the return was possible by building a sailboat with the two kayaks carried that allowed Nansen and his companion, to reach the Franz Josef Land. Nansen reinvented the catamaran in 1896: a sailing boat with two hulls, widely used in the Pacific since antiquity and which was first built in the West by an American naval architect in 1870, Nathanael Herreshoff.

1.3.4. *Exploitation*

Nansen mobilized all the knowledge he acquired during his youth about fishing and hunting during the winter period to ensure that he had fresh food throughout the

boat's journey. He also used all these techniques to survive during his forced hibernation with his companion on the island of Franz Josef Land.

The knowledge acquired during the crossing of Greenland on skis with sleds constituted a reference matrix to address many points for the expedition to the North Pole: preparation, team building, equipment, food, etc. But above all, it was the logistics he successfully deployed for Greenland that would serve as a support to design and implement the expedition to the North Pole: for example, the fact of testing first and foremost the equipment that would be used in the situation.

He wrote about this in his logbook of the Greenland expedition:

> "The success, even the salvation of an Arctic expedition depends to a large extent on the quality of its equipment. The failure of a nail or belt can sometimes have the most serious consequences for the caravan. Also before departure, it is recommended to carefully examine each object; neither time nor effort should be spared to obtain the most careful material possible". (Nansen 1996a, p. 25)

Jansen mobilized this knowledge in an even more precise way when he left for the North Pole on skis. This knowledge played an essential role in the performance of this completely new and extremely risky project, which would ultimately have a successful outcome.

The explorer also mobilized a great deal of scientific knowledge on ice drift and meteorology. Finally, he mobilized Sverdrup who was his second in command in Greenland and who would be his second on this expedition too and the captain of the Fram. It was the knowledge of a global competence on Arctic expeditions and also of someone who could assist him and replace him that was mobilized here by the choice of this second in command and captain of the Fram.

What is important to highlight here is the ability to mobilize these different action regimes throughout the expedition process if necessary. As Van de Ven and Sun (2012) point out, it remains to be specified, but how is the transition between these different action regimes was carried out? For example, when does the team perceive that a change of plan is needed?

1.4. A dynamic of knowledge expansion in terms of an epistemic community

Our work has highlighted the importance of the process of knowledge expansion in the development of polar expeditions throughout the project (Garel and Lièvre

2010), in line with the whole literature as we recalled in the introduction. Two types of knowledge appeared to be discriminating in this expansion process, with different forms, legitimacy, aims and also different modes of mobilization and use. These are experiential knowledge, on the one hand, and scientific knowledge, on the other hand (Lièvre 2016). Experiential knowledge is produced by actors in action and for action but it is implicit (Nonaka 1994; Lièvre and Rix-Lièvre 2012). Scientific knowledge is constructed by researchers, in the form of a written document, validated by peers but whose purpose is knowledge, not action (Callon *et al.* 2001). These results are consistent with work in the field of the knowledge economy, which also shows that it is the articulation between these two types of knowledge that allows the radical intensification of knowledge of activities in organizations (Callon *et al.* 2001; Amin and Cohendet 2003; Foray 2011).

We propose to report on the process of knowledge expansion in this exploration project from the theoretical framework of epistemic communities (Cohendet *et al.* 2006, 2014). Nansen succeeded in enlisting those around him, as described by Callon, for the expedition to the North Pole: a collective of heterogeneous actors with scientific and experiential knowledge proposed a new way of approaching the conquest of the North Pole. This new way took the form of a manifesto written by Nansen, which was enriched as the project was prepared and carried out, becoming a code-book via the expedition's logbook: it became a reference work in the polar environment. It supported an entire school in terms of polar expeditions that would succeed in the Northwest Passage, the North Pole and the South Pole. On the question of mobilizing actors in situations, see Marc Lecoutre's chapter (Chapter 20) and on the question of communities, see Jean-Philippe Bootz and Olivier Dupouët's chapter (Chapter 19) in this same book.

1.4.1. *The Intention*

Nansen formulated his intention in this North Pole expedition project follows "only the study of this polar desert – scientifically – is the purpose of my trip. In my opinion, the search for the mathematical point that forms the pole is of minimal interest" (Nansen 1996b, p. 19). But things were even more complex than that because it was necessary to link this intention to Nansen's life and learning trajectory. As we have shown in the first section of this chapter, Nansen was a polar expeditionary being who developed a sensitivity in terms of exploration and science that has been built into his life story. He had just accomplished a feat in polar expedition by successfully completing the first ski crossing of Greenland in 1888. He acquired considerable experience in experiential knowledge in the design and implementation of a polar expedition. He codified this knowledge in a book that went on to have some success. At the time, the quest for the Arctic was in vogue, and one of the main objectives was the North Pole. As a polar explorer, Nansen

systematically monitored all attempts at the time. It also follows the scientific debates around the nature of the Arctic and particularly the controversy we have raised between Petermann's theory on the Open Polar Sea and Mohn's theory on glacial currents.

1.4.2. *The spark*

Nansen was also rather inclined to follow the theory of glacial currents when he learnt that the wreck of the Jeannette was found 3 years after its disappearance off the Siberian islands, south of Greenland. This was the creative spark, the *spark* as Cohendet expresses it, referring to Koestler's work. For Nansen, the message was clear: it was necessary to design an expedition that took a ship the way taken by the Jeannette's wrecks to the North Pole.

1.4.3. *The manifesto*

In January 1890, he presented his project in the form of a communication to the Norwegian Geographical Society, what Cohendet called the manifesto, which was an alternative proposal to tackling the conquest of the North Pole and which took the form of a text:

> "It is necessary to design an expedition that follows the path taken by the wrecks of the Jeannette on a ship. To reach by sea the islands of New Siberia, from there advance as far north as possible, making a passage through the ice, then once all exits are closed in this direction, let yourself be carried to the NW by the slow drift that carries the waters of the icy ocean from Siberia to Greenland, that was the travel plan I was developing". (Nansen 1996b, p. 19)

1.4.4. *Various experts who formed a community around the project*

As we mentioned earlier, criticism is very strong, proof of the radically new nature of his proposal, but in the end Nansen still succeeded in enrolling the Norwegian government in Callon's sense in this adventure. The success of his expedition to Greenland and his reputation as a scientist would weigh heavily in this decision to financially support the project. Private donations increased spontaneously following the communication of this project by the press. He mobilized all around him and especially near Christiania he mobilized a whole group of experts who contributed to the expansion of the knowledge in this project.

Nansen's main concern was to have a boat built for this expedition. A boat capable of withstanding the pressure of the ice and equipped with a reliable engine, a small, solid and maneuverable ship capable of carrying fuel and supplies for 12 men for five years had to be built. He mobilized the Norwegian engineer Colin Archer, the best naval architect of the time and architect of more than 200 boats. He was the expert Nansen needed to achieve this technical feat.

He further mobilized and created around him a community of scientific and experiential experts residing mainly in Christiana during the preparation of the expedition: a chemist, two mathematicians, two meteorologists, a pharmacist, a physicist, a zoologist, but also a school principal, a principal and a lieutenant-colonel.

He chose teammates with particular responsibilities in the expedition but all having in common an experience of the sea and but also of the mountains. The commitment to the project and the recognition of Nansen as expedition leader was abundantly clear. The small group of 13 people lived together for 3 years.

1.4.5. *A continuous increase in implementing knowledge*

There was a continuous increase in knowledge by the crew both on board the boat and around the boat when it got stuck in the ice. Continuous scientific knowledge included boat drift, ice currents, algae, ice quality and sun observation for altitude, but also experiential knowledge of fishing, walrus and polar bear hunting, kayak construction and piloting, lifeboat construction and use, ski progression with dogs and sleds on the ice pack and camp installation on the ice pack.

When Nansen left on skis and sled with his teammate to try to reach the North Pole, the crew experimental twice (Lenfle 2008) in terms of speed and reliability before finding the right compromise and finally leaving.

The two expeditions returned to port 7 days apart in August 1896 in Norway.

1.5. Conclusion

Nansen's 1893 expedition to the North Pole has all the attributes of this new project category, which represents a considerable challenge in our contemporary organizations: exploration projects. Projects where objectives and means emerge throughout the project (Lenfle 2008) as shown in this expedition by Nansen. We were able to experience the heuristics of the extreme situations we constructed

(Lièvre 2016) by following the history of this project. The three founding registers of the organizational performance of extreme situations are positively present in this expedition: a project that makes "sense" because it is in coherence with an identity trajectory of learning, a radical capacity of ambidextrous externality demonstrated by the project manager and, finally, a dynamic of expansion of experiential and scientific knowledge through the creation of a collective that is similar to an epistemic community. At the managerial level, it would still be necessary to further characterize the nature of the organizational arrangement, a combination of these three registers that made this organizational performance possible.

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2

Project Management in Extreme Situations: The Manhattan Case

2.1. Introduction

Launched by the United States during the Second World War to design an atomic bomb, the Manhattan project occupies a special place in history in general and in project management in particular. It is a particularly interesting object of study for three reasons.

First of all, it is undoubtedly an extreme project (Lièvre 2014) because of the frightening innovation it brought to life and which undoubtedly constitutes a disruption in the history of humanity[1], the "unforeseeable uncertainties" (Loch *et al.* 2016) it had to manage throughout its development, because of its scale (130,000 people mobilized at the peak of the project), and finally because of its incredible speed (just under 3 years). Second, and because of these characteristics, the Manhattan project is often used in public debate to designate an organization capable of achieving extraordinary objectives. However, although it has indeed allowed the development, in record time, of a radical innovation, its organization and management remain little studied, paving the way to various interpretations on the transferability of this example to other situations. Finally, on a managerial level, it is often presented, wrongly as we will see, as the origin of modern project management methods (Lenfle and Loch 2010). In this chapter, we will analyze the management and organization of this project, which was extraordinary in many

Chapter written by Sylvain LENFLE.

1 The official history of the Manhattan project (Hewlett and Anderson 1962) is also entitled, rather aptlys, *The New World.*

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ways[2]. To do this, we will first briefly describe the origins of the project before characterizing the management situation it was facing and then the managerial strategy adopted. We will then study the organization set up and the project management systems. We will conclude by questioning the legacy of this project and its transferability to contemporary situations, typically the fight against climate change for which it is regularly invoked.

2.2. The origins of the Manhattan project[3]

The Manhattan project originated in a famous letter from Albert Einstein to F. Roosevelt on August 2, 1939. In it, he warned the U.S. President against the risk of Nazi Germany building an atomic bomb. This followed progress made at the time by F. Joliot-Curie, L. Szilard (who is the true author of the letter) and E. Fermi. Fundamental research in nuclear physics, a field that had been expanding rapidly since the 1920s and the pioneering work of E. Rutherford, showed at the time that it would theoretically be possible to trigger a self-sustaining chain reaction. However, at the time, this was still a very young field in which everything was theoretical and nothing had yet been demonstrated[4]. Einstein's letter did not lead to the launch of a project, but rather to the acceleration of research on the subject within American universities. The situation changed with the escalation of world conflict and accelerated with the involvement of the United States in the war in December 1941. Dissatisfied with the progress of work on the topic, V. Bush, head of the OSRD[5],

2 Here "extraordinary" (*extraordinaire*) is understood in the sense of that "which is not of ordinary use, according to the common (...) particular, special, exceptional order" (*Le Robert*) and not in its positive sense qualifying an admirable or remarkable result. Let us make it clear from the outset that we will not enter into the heavy ethical debates surrounding the project, debates on whether or not it was necessary to use the bomb against Japan and on the appalling consequences of a nuclear bomb. The interested reader should refer to Malloy (2008) for an introduction.

3 This article is based on a series of research studies to which the reader wishing to obtain more information may refer, in particular Lenfle (2008, 2011) and Lenfle and Loch (2010). In addition, the conference given at Cerisy is available at: http://www.unicaen. fr/research/mrsh/forge/4038.

4 As H. Smyth explained in a report published immediately after the Hiroshima incident: "there were many gaps and many inaccuracies. The techniques were difficult and the quantities of materials available were often submicroscopic. Although the fundamental principles were clear, the theory was full of unverified assumptions, and calculations were hard to make. (…) The subject was in all too many respects an art, rather than a science" (Smyth 1945, p. 365).

5 Office of Scientific Research & Development, in charge of coordinating the contribution of science to the war effort and which was really a kind of ministry of research.

and J. Conant decided to involve the US Army Corps of Engineers in the project, taking the codename of "Manhattan Engineer District" in July 1942. But it was the appointment of General Leslie Groves in September 1942 that, because of his experience and temperament (Norris 2002), truly launched the project.

The problems facing the project at that time were immense. Indeed, even if the principles of nuclear fission had been theoretically considered since the work of Meitner and Frisch (1938), the difficulties in designing a bomb were absolutely colossal. Broadly speaking, there were two fundamental problems: the production of fissile material and the design of the bomb itself. With regard to the first point, two solutions were envisaged: the extraction of uranium 235 from natural uranium and the manufacture of plutonium. Both were radical innovations that would require the development of completely new processes. Moreover, due to the novelty of the field and the lack of knowledge, no one was able to say which of the tracks envisaged (in the case of U235: electromagnetic separation, gas diffusion, thermal diffusion, etc.) was the best. The same went for the design of the bomb. Thus, during a seminar organized by R. Oppenheimer at Berkeley University in the summer of 1942, various solutions were considered (projection, implosion, autocatalysis, etc.), again without being able to say which was the most promising.

2.3. Exploring the unknown

As a result, the Manhattan project was facing what was known as *unforeseeable uncertainties* or *unknown unknowns* (Loch *et al.* 2006), a situation that has no precedent and for which it is impossible to anticipate possible risks. Due to the lack of knowledge, uncertainty was confirmed and they simply did not know what could happen next. The team had to explore the unknown. This point is illustrated by a visit made by L. Groves, shortly after his appointment, to scientists at the University of Chicago:

> "As the meeting was drawing to a close, I asked the question that is always uppermost in the mind of an engineer: with respect to the amount of fissionable material needed for each bomb, how accurate did they think their estimate was? I expected a reply of 'within twenty-five or fifty percent', and would not have been surprised at an even greater percentage, but I was horrified when they quite blandly replied that they thought *it was correct within a factor of ten*. This meant, for example, that if they estimated that we would need one hundred pounds of plutonium for a bomb, the correct amount could be anywhere from ten to one thousand pounds. *Most important of all, it completely destroyed any thought of reasonable planning for the*

> *production plants of fissionable materials*. (…). While I had known that *we were proceeding in the dark*, this conversation brought it home to me with the impact of a pile driver. There was simply no ready solution to the problem we faced, except to hope that the factor of error would prove to be not quite so fantastic" (Groves 1962, p. 40).

To manage this situation of radical uncertainty, Groves and the project's steering committee then adopted an extremely original managerial strategy: explore and implement the various solutions simultaneously. Groves' management philosophy was extremely clear and was systematically applied throughout the project:

> "A wrong decision that brought quick results was better than no decision at all. If there were a choice between two methods, one of which was good and the other promising, build both. Time was more important than money, and it took time to build plants" (expressed during the Technical Council, October 5, 1942, in Hewlett and Anderson 1962, p. 181).

Moreover, given the absolute urgency of the project, the steering committee decided in November 1942 to move directly to industrial installations without resorting to a pilot stage. Finally, again to save time, a radical concurrent engineering strategy was adopted: the construction of the plants began even though fundamental research was still underway. As Groves again explained:

> "I had decided almost at the very beginning that we had to abandon completely all normal orderly procedures in the development of the production plants. We would go ahead with their design and construction as fast as possible, even though we would have to base our work on the most meager laboratory data" (Groves 1962, p. 72).

As a result, the Manhattan project is in many ways the archetype of what the literature calls parallel[6] strategies of simultaneously exploring different technical solutions when "there is not sufficient scientific knowledge for a final choice to be made with any great confidence and the pressure of time is too great to permit alternatives to be tried one after another" (Nelson 1959, p. 33). Figure 2.1 shows this strategy in the Manhattan case.

6 In his works, C. Loch speaks of "selectionsim" to describe this approach. On this topic, see also Nelson (1961) and Abernathy and Rosenbloom (1969).

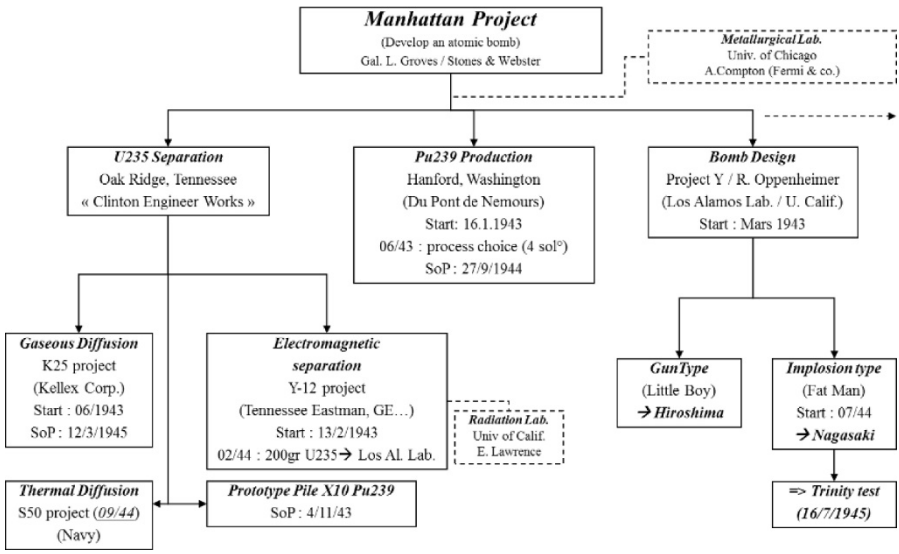

Figure 2.1. *Reconstruction of the Manhattan Project organization*

The project was implemented at three sites:

– in Oak Ridge, Tennessee, where two different methods of uranium enrichment were used. Electromagnetic separation seemed the most promising, but gaseous diffusion was also launched as a back-up[7];

– in Hanford, Washington, at the same time, construction began on the first nuclear reactor to produce plutonium, an alternative to enriched uranium;

– finally, in Los Alamos, New Mexico, construction began on a laboratory for the design of the bombs themselves. Here too, different solutions were being studied. Gun design seemed to be the safest way, but implosion was also being studied as a backup solution.

Without going into the details of the project's progress here (see Lenfle 2008 for an overview and the project stories or, for example, the recent overview by Reeds (2014)), it was this simultaneous exploration of different solutions that allowed the project to be completed in record time despite these radical uncertainties. Let us consider here only one example: the *spontaneous fission crisis* of spring 1944 linked to the discovery of the spontaneous fission of plutonium. This occurred at the Los Alamos laboratory, which was in charge of bomb design. For scientific and technical

7 A third solution, gaseous diffusion, was also added during the project (Lenfle 2011).

reasons, Oppenheimer and his colleagues decided to focus their efforts on designing a gun design bomb in which two pieces of fissile material were projected against each other to trigger the chain reaction that would lead to the explosion. Because of its novelty, scientists chose to study this design using plutonium, the hypothesis being that it would then be simple to adapt it to enriched uranium, which is *a priori* more difficult to produce. However, in 1944, the results of studies conducted under the direction of E. Segré in Los Alamos showed that this material was much more unstable than had been thought at the beginning of the project. It thus highlighted a phenomenon known as "spontaneous fission", which makes plutonium totally unusable in a gun-type design. This led to a major crisis in the laboratory because, at the same time, the project was facing the greatest difficulties in sufficiently enriching the uranium 235 that could be used in this type of bomb. Scientists therefore seemed to be at a dead end: on the one hand they had a promising bomb design[8], the gun, but for which they do not have any fissile material; on the other hand, plutonium seemed relatively easier to manufacture, but they did not know how to make it into a bomb. It is precisely here that parallel strategies demonstrated their relevance and helped to break the deadlock. Indeed, in parallel with the gun design, another, smaller team had been working since the beginning of the project on the implosion bomb. This firing mechanism had indeed been mentioned at the 1942 seminar and Oppenheimer found it interesting enough to dedicate some resources to it. However, this was a major technical challenge. In such a design, conventional explosives are placed around a plutonium core and must explode perfectly symmetrically inward to compress the core that will become critical and explode. Many in the Manhattan project and elsewhere found the task impossible. And yet, in July 1944, Oppenheimer decided to completely reorganize Los Alamos to give the implosion the same importance as the gun solution. New experts were recruited, departments dedicated to implosion created and external consultants (first and foremost J. von Neumann) were mobilized on the issue. From there, the Los Alamos teams worked simultaneously on two completely different designs: gun/uranium and implosion/plutonium. Given the uncertainties associated with the implementation, Groves agreed to test it. The first atomic explosion in history therefore took place on July 16, 1945 in the desert of New Mexico. The atomic bombings of Hiroshima (6 August) and Nagasaki (9 August) followed, leading to the surrender of Japan (14 August).

2.4. The Manhattan Project organization

We would now like to focus on the organization that made such a strategy possible. In this respect, the Manhattan project also marks a disruption. It thus

8 Although very complicated, because the bomb in question must be able to be used for aerial bombardments, which leads to serious constraints as to its size, weight and preparation.

constitutes the archetype of the alliance, on a scale never before seen, between the military, science and industry[9]. This confrontation of military and scientific logic with the support of industry constituted a social and organizational disruption that would allow this extraordinarily rich and effective exploration. And it was the implementation of a *project* that made it possible to catalyze these different elements. In this process, the appointment of General Leslie Groves played a fundamental role. His experience of major projects and his temperament (K. Nichols: "he disregards all normal organizational channels" in Reed (2014, p. 165)) undoubtedly made him the "indispensable man" of the Manhattan project (Norris 2002).

As J. Landsdale, Project Security Manager, explains:

> "General Groves is a man of extraordinary ability and capacity to get things done. Unfortunately, it took more contact with him than most people had to overcome a bad first impression. He was in fact the only person I have known who was every bit as good as he thought he was. He had intelligence, he had good judgment of people, he had extraordinary perceptiveness and an intuitive instinct for the right answer. In addition to this, he had a sort of catalytic effect on people. Most of us working with him performed better that our intrinsic abilities indicated" (Reed 2014, p. 165).

In particular, Groves accelerated the linking of the three elements. To take just one example, he obtained on December 21, 1942, i.e. 3 months after his appointment, the commitment of DuPont de Nemours in the design and construction of nuclear reactors for plutonium production, mainly at Hanford[10]. The organization of this part of the Manhattan project is typical of this science/armed/industry collaboration. At Hanford, there were three actors:

– Col. Matthias, a military manager[11], who reported directly to Groves;

– an industrial prime contractor, in this case DuPont de Nemours, who, for this project, created a special division called TNX headed by C. Greenewalt[12];

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9 The radar project at MIT within RadLab is the other typical case of this alliance (see Buderi 1996 for an introduction).

10 It should be noted that at the same time Groves signed similar contracts with Westinghouse, GE and Allis-Chalmers to build the electromagnetic separation plant. And the same is true for the different parts of the project.

11 The sites are "government owned/contractor operated".

12 Who later became CEO of DuPont.

– scientists at the Metallurgical Laboratory at the University of Chicago, in charge of research, but also of nuclear reactor design.

And this new collaboration, under the very strong constraints of a military project, did not go smoothly. C. Greenewalt noted in his diary on December 28, 1942:

> "No mechanism yet devised for unloading and sorting, no flow sheet, operating manual or program. No clear idea as to what Du Pont is expected to do — Hell! The first thing to do is to work out an operating organization. [...] I believe we must infilter pile design in spite of the fact that we aren't very welcome" (Galison 1997, p. 254).

And, in fact, the conflict between the Met Lab and DuPont was violent. Perhaps the most emblematic case is the design of the Hanford reactor, where there was a conflict between scientists (E. Wigner) and engineers from DuPont (Greenewalt). Schematically, E. Wigner wanted to size the pile as accurately as possible according to his theoretical calculations (the circle in Figure 2.2). On the contrary, DuPont, with its experience in the industrialization of innovative processes, argued in favor of overdesigning the nuclear reactor just in case. In any case, it was because of this overdesign that the team was able to overcome the unexpected phenomenon of Xenon poisoning that occurred during the launch of the Hanford reactor in September 1944.

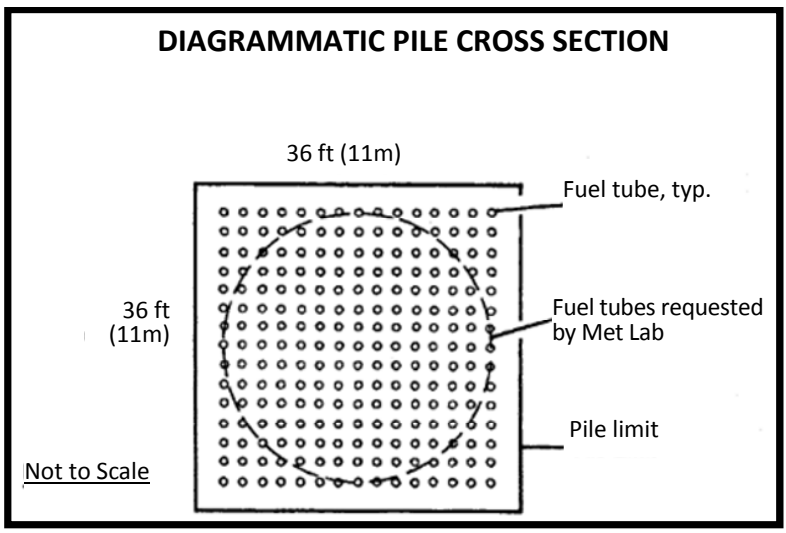

Figure 2.2. *Cross-section of the Hanford reactor design*

We see here both the difficulties and the effectiveness of science/industry collaboration, which made it possible to integrate the knowledge of scientists and engineers to develop totally innovative processes very quickly. In doing so, the Manhattan project inaugurated a new type of innovation organization that systematized direct collaboration between scientists and engineers and would have a major impact on innovation management practices in the United States during the Cold War (see, for example, Galison (1997) for the evolution of the physics research organization, Hughes (1998) for major military projects or Gertner (2012) for the Bell Labs example).

2.5. Project management as sensemaking

However, managing this type of project is a considerable challenge, as we have seen in the first section, because the unforeseeable uncertainties that make traditional project management methods ineffective. The project should be understood here not as convergence toward a clearly defined objective from the outset, but as a process of learning through experimentation (Loch *et al.* 2006; Lenfle 2008).

One of the difficulties then consists of giving meaning in real time to a continuous flow of more or less unpredictable events (and rather more than less), what K. Weick calls sensemaking. In a classic 1993 article, Weick defines sensemaking as follows:

> "The basic idea of sensemaking is that reality is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs. (…) It is about contextual rationality. It is built out of vague questions, muddy answers, and negotiated agreements that attempt to reduce confusion" (Weick 1993, pp. 634–636).

Loch *et al.* (2006, pp. 175–177) use Weick's work as a basis to show the difficulties of managing the highly innovative projects they study. In a later article, Weick uses the metaphor of the mapmaker to illustrate the difficulty of this process. For example:

> "The task of sensemaking resembles more closely the activity of cartography. There is some terrain that mapmakers want to represent, and they use various modes of projection to make this representation. What they map however depends on where they look, how they look, what they want to represent and their tools for representation. (…) The terrain is not itself already mapped such that the job of the sensemaker

> is to discover this preexisting map. For mapmakers the idea of a pre-ordered world has no place or meaning" (Weick 2001, p. 9).

One can only be struck by the proximity with the words used by Hewlett and Anderson, the first official historians of the project, to describe the difficulties encountered by E. Lawrence's teams in charge of uranium enrichment by electromagnetic separation at Oak Ridge:

> "Like scouts on a vital mission through unexplored territory, Lawrence's subordinates could not wait for maps to be prepared for their journey; they would have to strike out for their destination and hope that they would stumble on the shortest and easiest route. Experiments, not theory, had been the keynote at Berkeley. The magnetic shims, sources, and collectors that gave the best results were used, although no one could explain their superiority" (Hewlett and Anderson 1962, p. 142).

The challenge is how this process is managed within a project. And nowhere has this problem been more prominent than in Los Alamos.

Created in February 1943 to work on bomb design, the Los Alamos laboratory was the central nucleus of the Manhattan project. This was where fissile materials converged to make atomic bombs, and where all the scientific and technical work on the design of firing mechanisms took place. As a result, Los Alamos had to constantly adapt to the unpredictable developments of the project, compounded by the difficulties associated with the exponential growth of the laboratory, whose population reached 8,750 in June 1945. Consequently, as Thorpe and Shapin note, "throughout the war, the organisation of Los Alamos was in a continual state of flux and turbulence" (Thorpe and Shapin 2000, p. 557). And indeed the organization of the laboratory has constantly followed the evolution of the project. The *spontaneous fission* crisis of spring 1944 is the most striking illustration of this, since to design the implosion bomb, Oppenheimer totally reorganized the laboratory, creating new divisions, closing others, hiring experts on new issues, etc. Thus, the Los Alamos structure "was by nature ephemeral; experiments and responsibilities changed overnight as priorities that the war gave to the project changes" (Hoddeson *et al.* 1993, p. 247). Its history is marked by a constant flow of reorganizations, with the laboratory moving in the space of 2 years from research to development and then production within an increasingly structured militaroscientific complex (*weaponized* is the term used by Thorpe and Shapin).

In this maelstrom, it is possible to identify at least two devices that have made it possible to give meaning to the ongoing developments: the project manager and the weekly meeting, the Colloquium. Regarding the first point, it is striking to note,

among the stories and testimonies about Los Alamos, the predominant role played by R. Oppenheimer. V. Weisskopf, a member of the theoretical physics department of Los Alamos, sums up his role well in a testimony following his death:

> "He did not direct from the head office. He was intellectually and even physically present at each decisive step. He was present in the laboratory or in the seminar rooms, when a new effect was measured, when a new idea was conceived. It was not that he contributed so many ideas or suggestions; he did so sometimes, but his main influence came from something else. It was his continuous and intense presence, which produced a sense of direct participation in all of us; it created that unique atmosphere of enthusiasm and challenge that pervaded the place throughout its time" (Weisskopf 1967).

The project manager thus played a role of focal point for the various actors of the project. This was all the more so as it is based on organizational mechanisms for sharing knowledge between actors that allow an adjustment of the project management process (see Lenfle 2016). This was typically the role played in Los Alamos by the Colloquium, a weekly meeting of the various scientists involved in the project. Let us follow here Thorpe and Shapin in a passage that deserves to be quoted at length:

> "The Colloquium, more than any other local organizational form, was understood both to express and to enable solidarity and integration. Los Alamos scientists were, almost without exception, highly concerned that each should have an overall sense of how their specialized work fitted into the specialized work being done by others, and into the instrumental goals of the laboratory as a whole. Information, they reckoned, should circulate throughout the laboratory as efficiently as practicable. (…) The solution was simply to provide for more face-to-face and free interaction, to encourage meetings and discussions at as many levels as possible and among as many specialized work groups as possible. This is how and why the weekly Colloquium for all staff members assumed such importance. The Colloquium was considered important as a means of disseminating information, and also as a way of creating solidarity and face-to-face accountability. (…) General Groves agreed that the Colloquium 'existed not so much to provide information as to maintain morale and a feeling of common purpose and responsibility" (Thorpe and Shapin 2000, p. 570).

Thus, as the authors show, we find this type of device in the majority of very innovative[13] projects to consolidate and discuss the latest information and make decisions about the way forward by considering what we have learned. We also note, with amusement and interest, the predilection of the Colloquim members for "the production and displays of organizational charts [which] were interesting to participants as symbolic representations of coherence and stable order amid uncertainty and change. So the mathematician Stanislaw Ulam writes of Los Alamos 'fascination with organizational charts. At meetings… whenever an organizational chart was displayed, I could feel the whole audience come to life with pleasure at seeing something concrete and definite'. This symbolic display of coherence was one way of making the organization appear legitimate and functional" (Thorpe & Shapin, 2000, p. 557). This is even if, as noted by Colonel Tyler, commander of Los Alamos at the beginning of 1945, "he had been unable to find any organizational chart which had any meaning"[14] (Thorpe & Shapin, 2000, p. 558).

2.6. The expansive legacy of the Manhattan project and the limit of the metaphor

Without going into the ethical issues involved in such a project (see Malloy 2008 for an introduction), the Manhattan project remains an unprecedented scientific and technological achievement. In 2 years, the United States developed, with a budget of $2 billion at the time, two atomic bombs of totally different designs, which had proved their frightful effectiveness. As such, the Manhattan project opened the new world of atomic energy and weapons of mass destruction. Ongoing debates on the beginning of the anthropocene often go back to the Trinity test of July 1945.

In addition, beyond these immediate outcomes, the Manhattan project has had a particularly expansive legacy (Lenfle 2012).

On a technical level, it thus constitutes the matrix from which lineages of imploding bombs were developed, the power of which was multiplied by 25 between 1948 and 1952 (and even more so afterward), but also different types of nuclear reactors for civil and military applications. These developments are obviously based on the enormous knowledge base created by the project, including the technical contributions "covering the full range of science and technology, from

13 See, for example, Brown and Eisenhardt (1997) for IT; Spinardi (1994) for Polaris; Hughes (1998) for Atlas; Westrum (1999) for Sidewinder, etc.

14 A similar anecdote can be found in Loch *et al.* (2006, p. 172) about a group of soldiers lost in a storm in the Swiss Alps who had found their way back after being reassured by the fact that one of them had a map that turned out, once back at the base, to be a map... of the Pyrenees.

chemistry, physics and the science of explosives to revolutions in electronics and microelectronics"[15] (Hoddeson *et al.* 1993, p. 416), which were disseminated through articles, plans, books and courses organized by the Atomic Energy Commission, created on August 1, 1946.

At a managerial level, the Manhattan project has served as a model for managing the major weapons projects launched by the United States from 1950 onwards in the context of the Cold War. Parallel strategies can be found in the Atlas (1954–1959) and Polaris (1957–1960) projects, but also in the development of the first nuclear submarines (1951–1958)[16]. It is therefore particularly surprising that these strategies disappeared completely from the standard literature in project management from the late 1960s onwards (Lenfle and Loch 2010).

Finally, there is the question of the impact of the project on people's minds and its transferability from this model to contemporary problems. It is thus indisputable that the Manhattan project has contributed considerably to the extraordinary image of scientists in post-war America and to the belief in the infinite possibilities of scientific conquests[17]. Let us mention here only the famous Vannevar Bush report, which played an essential role in launching and supervising the Manhattan project, *Science: the endless frontier*, published in 1945.

The need for a "Manhattan project", particularly to fight climate change, is thus regularly invoked in public debate. Naomi Oreskes, for example, invoked it in a New York Times article in 2013[18] and all you have to do is type the query into Google to see thousands of references appear[19]. However, this transfer seems to us to be at the very least hazardous. It is therefore useful to highlight what is special about the case. Perhaps the most important point is that this was a military project conducted in a situation of total war. As soon as he was appointed, L. Groves requested and obtained the ranking of the project as an absolute priority. The impact of this decision was major since it solved both the question of available resources and the question of encouraging stakeholders, especially when the project

15 Metropolis and Nelson (1982) and Aspray (1990) should be read with interest on the role of Los Alamos in the design of the first computers.

16 Actually, the director of the Atlas/Titan project, B. Schriever, discussed the issue directly with Groves and Oppenheimer. See Hughes (1998) for Atlas, Sapolsky (1972) for Polaris and Hewlett and Duncan (1974) for the Navy.

17 But it is also true of the development of radars and, more generally, of the fundamental contribution of science to the victory of the Allies.

18 http://www.nytimes.com/roomfordebate/2013/11/14/is-nuclear-power-the-answer-to-climate- change/we-need-a-new-manhattan-project-to-deal-with-climate-change.

19 "Manhattan project climate change" thus generated 5,240,000 results on February 27, 2017.

management was carried out by Groves. The Manhattan project was thus able to rely on the massive mobilization of the flagships of American industry (GE, Westinghouse, Stone & Webster, DuPont, etc.) and on all those that the United States counted as Nobel Prize winners (current or future; the list is impressive: E. Fermi, J. Franck, E. Lawrence, A. Compton, J. Chadwick, E. Wigner, L. Alvarez, H. Bethe, G. Seaborg, etc.). Second, it was a totally secret project. The absolute need to protect against any form of espionage and Groves' draconian policy of compartmentalization meant that very few people were aware of the existence and organization of the Manhattan project. As a result, the issue of stakeholder management did not arise, or only very marginally, in the Manhattan case. Finally, the objective of the project, although extraordinarily complex scientifically and technically, was clearly limited to the design of a bomb.

Here, we measure the specific nature of the situation and the limit of the metaphor to deal, for example, with the issue of climate change. The latter case is in many ways the opposite of what the Manhattan project was, that is, a closed project. One only has to read, for example, the famous *Stern Review on the Economics of Climate Change* (Stern 2006) to understand that the problem of climate change is (1) extremely open, since it concerns the functioning of society as a whole, and (2) confronted with the major issue of encouraging actors to take mitigation or adaptation actions now for extremely distant benefits. Here, we come to the literature that points to the limits of the transferability of project management methods developed primarily to manage closed military projects to open issues such as urban planning or climate change (Hughes 1998; Lenfle and Loch 2017).

It should be noted, in conclusion, that this does not mean that the management methods used in the Manhattan project have lost their relevance. On the contrary, we believe that they prefigure a management model for what we call exploration projects (Lenfle 2008, 2016). But it is not possible, as the standard project management model does, to blindly apply these methods to all situations.

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SECTION 2

Exploration Testimonies

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
First Edition. Edited by Pascal Lièvre; Monique Aubry and Gilles Garel.
© ISTE Ltd 2019. Published by ISTE Ltd and John Wiley & Sons, Inc.

3

Exploration, the Common Theme of a Training System on Innovation

This is the story of an adventure of more than 3 years experienced within the Michelin group; an experience of a co-development approach based on a mode of exploration in search of innovative behaviors. This collective intelligence work has given rise to a training system on innovation for the group's managers.

3.1. The initial context at the origin of the adventure

The Michelin Group has built a large part of its development on a strategy of technical innovation that has enabled it to be recognized for a long time as one of the leaders in its field.

In 2013, the group faced various challenges to move on:

– from the proposal of the best tire product to the best response and customer service distributor or consumer;

– from market analysis to optimize the value chain and production process to digital strategy to optimize the B2B or B2C market customer experience;

– from the primacy of expertise in exploitation processes to the primacy of customer experience to ensure long-term loyalty;

– from the standardized innovation process to the agile short-loop mode.

The company then worked hard to optimize and streamline the various processes in order to achieve exploitation excellence. These actions have brought significant

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Chapter written by Bruno STÉVENIN and Éric DÉPRAETERE.

gains in economic performance, but have sometimes limited the company's ability to adapt through excessive rationalization.

The group became aware of this and made the link with the new market situation symbolized by the "VUCA" concept of the United States Army's reflections to characterize the new theaters of operations (volatility, uncertainty, complexity, ambiguity). An analogical application of this concept to international mobility market conditions highlights its volatility, uncertainty, complexity and ambiguity and the many risks of disintermediation.

Innovation is one of the key elements of the company's ability to adapt. As early as 2013, the group's president launched a renewed call for "Innovation for all" through a dynamic, agile, fast and frugal approach.

Compared to a logic centered on exploitation and rationalization, a change in mental model was then required and had to lead to a strong evolution of collective behavior.

Bruno Stévenin, in charge of *Management Learning & Development*, questioned: "How can we strengthen the role of managers as the driving force behind this evolution by stimulating it without ever slowing it down?"

3.2. The launch and preparation of the training program characteristic of exploration

A few key topics structured the first steps forward:

– is it possible to design and propose a collective, multicultural and multitrade training program deployed with a mixed population?;

– experienced R&D professionals who would be waiting with an amused look trying to teach them about innovation;

– industrialists or functional people experienced in the application of precisely described processes who would question us on the interest of this approach in a constrained and/or standardized universe.

We reasoned that it was likely that a factory manager invited to an exploration management program may ponder in the early hours: "why should I be concerned, as an operator, whose main effort is to apply Lean standards?". Their objective was to come out understanding that exploration is essential to the survival of their exploitation.

The boss' request was clear, "all innovators!". We had to move away from the "creativity" approach and its implicit mental schema of a brilliant idea of a person who leads the project and leads for innovation. The problem was not the lack of ideas, the innovation of one is a myth and failure is often linked to the inability to ask the right question. It was also necessary to move away from the myth of the "technological miracle", considered as the only one capable of responding to the need to innovate. This is all the more difficult because past successes have been based on this myth.

In the same way, we had to avoid any binary typology that opposed two profiles: creative/non-creative, deductive/inductive, innovative/operator; this approach could have been fossilizing and against an essential collective work in innovation. In addition, the same person may or may not become innovative depending on the environment and authorities. The mission was then no longer to make everyone a highly creative person, but to make some progress, starting with those who had the most room for it. Attention was also be paid to people who were not very innovative or whose role was to prevent risks and who, as a result, could be tempted to slow down an innovative dynamic, especially in a position of responsibility.

How then to proceed without formal authorization at this stage? Beyond the president's speech, no formal hierarchical request, no agreement had been formulated; informal exchanges with members of the executive committee had clearly shown their receptiveness, but then there was the problem of finding the time and budget.

An exchange with the future sponsor of the program, the Group R&D Director, made it possible to define the framework for this action:

– train on a 2-day basis with multitrade sessions;

– co-develop in an agile way with external consultants (trials, tests, adjustments, etc.) and connect with the international community (United States, China);

– be able to eventually deploy internally by training trainers;

– open up the pedagogy to external cases not involving Michelin.

How then to integrate the experience into this exploration phase? Another program recently designed at the time for "group level experts" in order to develop their leadership skills could have been used as a source of inspiration. But this included 2 weeks on new approaches to innovation: one week with internal group R&D executives, external consultants or actors of a major breakthrough, a second with a Study Tour in Silicon Valley. So how could these "2 weeks in 2 days" maximum be summarized for large deployment training?

How to optimize co-design and external avenues?

Two “almost” improbable meetings were crucial to building the core team that would work on the program. The first allowed a rich connection between the field of human resources (B. Stevenin as Director of *Management Learning & Development)* and that of R&D (E. Dépraetere as Research Director).

The second connected two innovation management experts (and therefore competitors) already working independently for Michelin. One day when they met, Bruno Stévenin was struck by the coherence and complementarity of the approaches of these two experts, Pierre Dhuy (PH8) and François Raffin (Auki), as he left one to meet the other. He suggested that they meet to explore the possibility of joining forces to “explore” a program. After a first meeting, they gave their agreement, which was in itself a real challenge because of their potentially competing positions.

How then to find motivated internal facilitators? The good news was the sharing of this question by the group level experts already trained in the long program, who asked “how can we transmit what we have received to others?” and positioned themselves as partners for the future and as members of a support network and potential facilitators.

3.3. The heart of program design: a step-by-step exploration

After the decision to launch what was at this stage an “exploration”, a first question arised: how can we change the mental model of innovation experts to infuse them with the entrepreneurial virus?

A first war room workshop was organized with the participation of group leaders and innovation experts in turn. The disruption here was to take a steering group and invite them over for two days to visit us and help us choose, in a “visual co-creation room”, the best training concepts to facilitate the cultural change they would have to bring as leaders.

Three targets were set during this workshop: specify the objective of the training, raise awareness among managers about the training of their teams and begin co-design. In parallel, interviews with some twenty executives were conducted, with questions such as: “What progress do you think we should make in innovation management?” or “Among the concepts and visuals proposed, which ones do you think are the most relevant and conducive to progress?”. Two major concepts stood out: learning styles and a logic of exploration/exploitation.

The following contributions were particularly relevant and were chosen as the pedagogical basis for the program:

– David A. Kolb's (1981) conceptual approach to learning styles (experience, reflection, conceptualization, experimentation), which invited us to create pedagogical tools that were transversal to these styles and motivate us to reach as many channels as possible, especially that of emotion through experience. A conference given by Professor P.M. Lledo (Institut Pasteur and CNRS) also showed us the importance of emotion in learning;

– the choice of educational games that include game boards, with objects, allowed a playful approach, choices combining gestures and speech, made it possible to restore the often frequent imbalance between introverted and extroverted people in the sense of the MBTI (Myers Briggs Type Indicator) and had the goal of better freeing players from their ego;

– the game laid the foundations for the reuse of these pedagogical tools in real life on real exploration projects;

– the conceptual approach of Professor James G. March that gave us the educational gateway to our approach, based on the image of oil companies that clearly distinguish their exploration and exploitation activities.

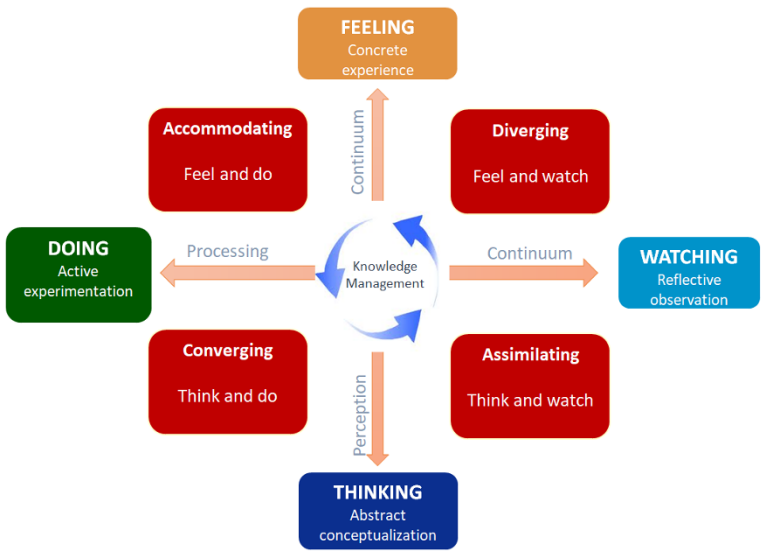

Figure 3.1. *Learning styles according to David Kolb*

"Organizations engaging in exploration to the detriment of exploitation are likely to find that they suffer the costs of experimentation without gaining many of the benefits. They exhibit

> too many undeveloped new ideas and too little distinctive competence. Conversely, systems that engage in exploitation to the exclusion of exploration are likely to find themselves trapped in suboptimal stable equilibria. As a result, maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity" (March 1991).

During the training, a simulation exercise to explore the Massoala canopy in Madagascar was proposed (see the work of tropical botany Professor Francis Hallé (2017)).

The argument proposed to the participants was as follows: in the 1980s, Hallé, asked the following question: "We are able to go to the Moon, but unable to explore the upper canopy of the primary forest located about 30–50 meters above the ground, and the interface between this forest and the atmosphere. However, this ecosystem must have a rare diversity of life. You are the members of the first expedition of this exploration, what are you doing before, during, after?"

The first sessions were revealing: the richness of the answers was exceptional; the consultants had only a few elements to question or add. The question that then emerged was naturally "Since we know what to do, why don't we do it in real life?"

In Professor Andrew Hargadon's approach:

> "Organizations must perform efficiently to survive and thrive in their current environment, but they must also retain the ability to adapt should the environment change. The tension is between adaptation and adaptability, between the exploitation of current resources and opportunities and exploration for new ones" (Hargadon 2003).

A question then arose: "Are management actions fundamentally different in the two modes of exploration and exploitation?"

First, we considered that the same management actions were necessary in both operations and exploration.

However, it was demonstrated that they were not and often could not be exercised in the same way, with the same behaviors and the same management postures. It was a question of making people aware that an approach that is too monolithic in this field leads to managerial misinterpretations that result in all exploration initiatives stopping. We sought to identify these key management acts and consensus was reached on the following main acts.

Define an objective

Manage

Build and transform the team

Support and evaluate

Change from “exploration” to “exploitation” (or vice versa) mode

Communicate

Connect

Create value

Box 3.1. *Main management acts*

The basis of reasoning was the uncertainty that differentiates the context of exploration from that of exploitation. Many managers tried to remove this uncertainty (by denying it). It was more appropriate to “tame” it step by step through “collective learning”. This is one of the characteristics of living organisms.

We therefore concluded that the mindset behaviors and skills are different, as well as the roles and postures of the stakeholders. Very naturally, we had in fact identified what would constitute as the core of the training.

A first prototype of the program was then developed on the following basis:

– a focus on behavior (the innovation process itself was outside the scope of training);

– tools were created to support an active pedagogy for exploration (canopy role play, compass, expedition map, etc.);

– a lively pedagogy with the design of friezes reflecting internal and external histories (rolling resistance, penicillin, Tesla) that highlighted the fundamentals of time duration and connections;

– practical anchoring with “management maps” describing the different postures and behaviors of the same management act according to its exploration and exploitation context.

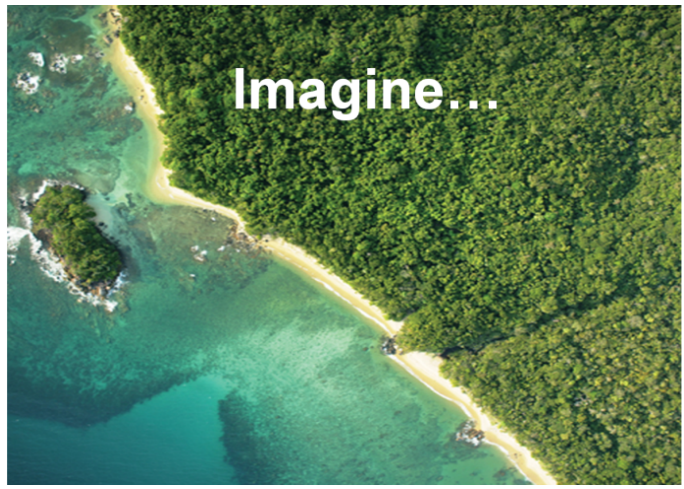

Figure 3.2. *"Canopy" role-playing game*

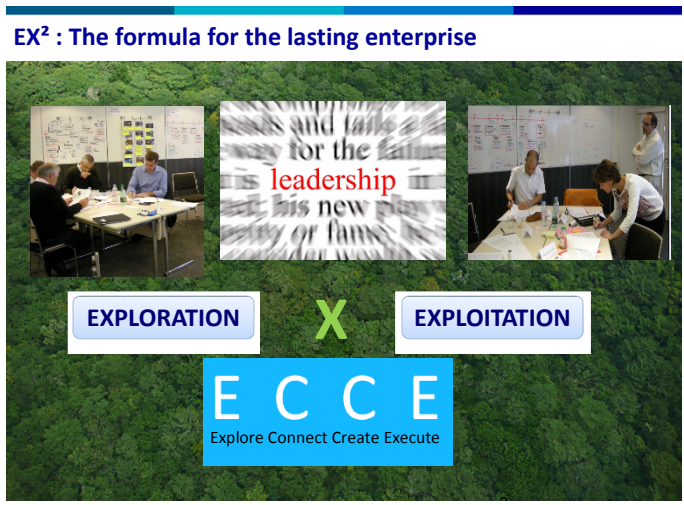

Figure 3.3. *Illustratating the necessary balance between exploration and exploitation to ensure the company's sustainability*

These cards were capitalized on with the writing of a manual and the collection of the best behaviors and postures. It was born from the compilation of the lessons learned from the study tours, the teachings of external managers in our programs, the experience of the consultants and feedback from the first sessions.

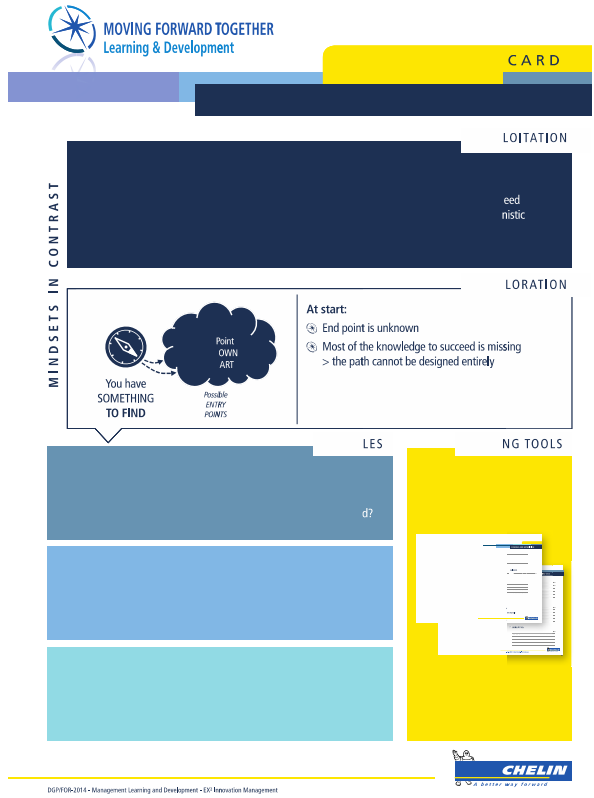

Figure 3.4. *Example of a "management card"*

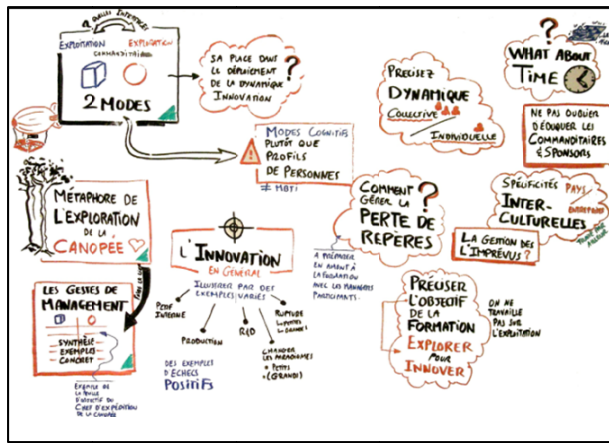
2 MODES
MÉTAPHORE DE L'EXPLORATION DE LA CANOPÉE
LES GESTES DE MANAGEMENT
L'INNOVATION EN GÉNÉRAL
MODES COGNITIFS PLUTÔT QUE PROFILS DE PERSONNES
COMMENT GÉRER LA PERTE DE REPÈRES ?
PRÉCISEZ DYNAMIQUE COLLECTIVE INDIVIDUELLE
WHAT ABOUT TIME ?
NE PAS OUBLIER D'ÉCOUTER LES COMMANDITAIRES & SPONSORS
SPÉCIFICITÉS PAYS INTER-CULTURELLES
LA GESTION DES IMPRÉVUS ?
PRÉCISER L'OBJECTIF DE LA FORMATION
EXPLORER POUR INNOVER
ON NE TRAVAILLE PAS SUR L'EXPLOITATION
DES EXEMPLES D'ÉCHECS POSITIFS
PRODUCTION
R&D

Figure 3.5. *Visual summary of the main messages*

Pilot sessions to test the program were held in France, the United States, China and Japan from March to December 2014. These sessions validated the relevance of the chosen concepts and in particular the exploration/exploitation logic that is understood by all business and national cultures. Additional questions were raised by the various participants on the following themes: risk-taking and emotions, the permission to explore and the transfer of exploration/exploitation, strengthening the "real-life stories" approach.

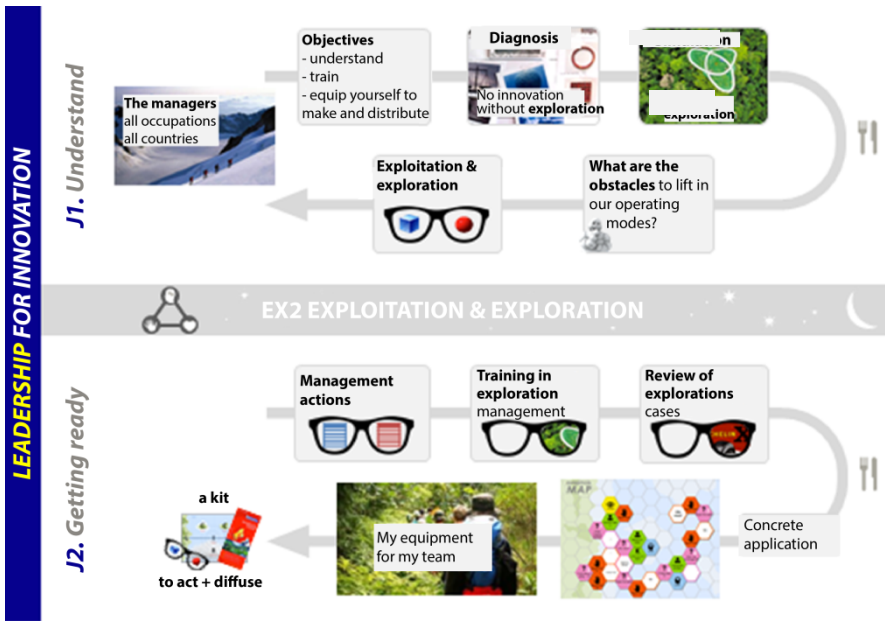

Figure 3.6. *Macro of the training course*

Finally, at the request of the participants, 1-day post-training workshop sessions were organized to concretely start the entities' exploration topics using the proposed pedagogical tools with the help of the consultants (Auki and PH8).

This prototyping phase in the field ended at the end of 2014, with a presentation of the approach to the group's Executive Committee to validate the main lines of development of the mental model (summary of interviews with managers) and the deployment plan.

The summary of the interviews indicates the following points for the evolution of the mental model:

Speed: accelerating via an eco-system of innovation.

Exploration: strengthening the ability to start/stop projects.

Ambition: amplifying disruptions through staggered market innovations.

Risk-taking: possibility of test and failure with learning.

Transformation: evolution of the mental model and behavior.

Training: agreement on the need for training.

Box 3.2. *Axes of evolution in the mental model*

Strong support from the executive committee was obtained for the next deployment.

Figure 3.7. *Timeline of training deployment*

A reduced format (one evening + one day) was required for entity management top teams (group functional departments, business departments or geographical zones).

3.4. The transition to exploitation

From the beginning of 2015, the deployment of the program was launched. Two training sessions for internal trainers were held in France and the United States, which

allowed the sessions to be conducted with pairs of external consultants and dedicated internal facilitators. It should be noted that internal trainers were operational on duty and not training professionals. They also had the role of "referent" for their entity and the geographical zone in which they operated. At the end of 2015, the North American zone decided to deploy training for all its managers. The multi-business session offer was completed by shorter management team sessions (2 h + 1 day), and by "special" sessions for existing teams. Over the years 2015 and 2016, approximately 70 training sessions were carried out per group of 17 participants on average. As a result, more than 1,200 people were trained by the end of 2016.

At the request of the participants, workshops to accompany full-scale exploration were offered after the training. Every month, two or three subgroups came with their real cases of exploration to work with the pedagogical tools (compass, expedition card, frieze, etc.) assisted by a consultant.

The questions arising from the pilot sessions in the different areas were:

– risk-taking: how can we deal with this subject in less than 1 h? How to treat them in Asia, where saving face is essential?

– permission to explore: how can we ensure that leaders are exemplary in the face of exploration?

– exploration/exploitation transfer: what are the best practices for switching from one mode to another (exploration → exploitation or vice versa)?

Figure 3.8. *Expedition card*

The lessons learned from the exploration for a training program were:

– this exploration taught us to "think together"; the maieutics became collective. A collective approach to behavioral differences adapted to the phases of innovation found its audience and significantly strengthened collective motivation. A shared culture requires a common vocabulary. Today the word exploration has taken on a strong and shared meaning in the group;

– a true maieutics of co-creation is not realized in events with walls filled with post-it notes. It is done in small, hyperconnected and agile groups. It opens the door to a higher degree of integration and collective intelligence, provided that teams are prepared with common sense, guiding questions, a real mutual trust based on a recognized professionalism of a multitrade/multiconcept and multiskilled team members;

– the practice and command by individuals and teams of both exploration and exploitation modes are key factors in the success of innovative projects. These are the fundamentals of sustainable growth. To this end, we have introduced work sequences on the participants' personal explorations. They tell these stories in subgroups, choosing the richest lessons for the group in relation to a given mental process (explore and collect, connect, create, exploit) and present it in plenary;

– the pedagogy of success was at the heart of the approach: short sequences in which we see ourselves succeeding in the unexpected with expert facilitators who remain in the "bravo, but go further!" mode;

– neuroscience shows that brain connections are differentiated according to the two modes and their associated behaviors;

– to start an exploration, it is not necessary to be numerous. A team of two or four people is powerful as long as they share a passion or vision where everyone finds a personal meaning with the action. Here, two of Michelin's directors together with two external consultants shared the same observation and vision for innovation;

– the design phase must not drag out and it is preferable to move very quickly to experimentation in the field itself, especially in the case of a training program;

– the characteristic of an exploration of the unknown is to reveal gaps: resources, expertise, tools. This led us to create new tools to answer the new questions asked during this training. These new types of pedagogical tools are mainly catalysts for guiding questions and do not provide access to standard answers to be applied;

– the presence of multitrade participants made this training a magnificent laboratory of collective intelligence. "We're smart together" on topics we know almost nothing about at the beginning. The notion of exploration/exploitation has been very well received both by professions where innovation is at the heart of the

activity, such as R&D or marketing, but also by professions where exploitation is very largely dominant, such as production. Exploration in this case seems all the more necessary to them because it is the source of the ability to adapt to a very rapidly changing world. It is also remarkable to see that this logic is also understood by the different cultures of countries and thus seems to show the "intrinsically human" dimension of exploration;

– a "managerial" training program targeting a change in culture and state of mind is richer and more effective when it directly connects academic research concepts with pedagogical tools to anchor in everyday life the actions considered as relevant. Our connection with the research and concepts of March (1991) and Hargadon (2003) for exploration/exploitation, with research published on neuroscience, that of Howard Gardner on multiple intelligences and of Kolb (1981) for learning styles, has demonstrated its effectiveness in practice and the rather exceptional assessments of participants;

– the managerial dimension of the exploration/exploitation logic is very close to the empowerment approaches that are currently being developed in management to restore freedom, autonomy, meaning and pleasure at work. The exploration of its great inherent uncertainty cannot be carried out without these axes being truly implemented in the field. It is indeed a very favorable experience to develop empowerment;

– but a change of culture cannot be copied: it is explored and developed. We have therefore avoided simply following fashions and their slogans (such as a liberated enterprise and happiness at work). To be successful in learning, it is necessary to make the best behavioral practices "emotionally" felt in exercises to simulate an experience that is out of touch with everyday life.

3.5. Conclusion

– Exploration is the main path to responsibility, the real target of the transition to innovation for all, if it is oriented toward the purpose of customer experience.

– There is no successful innovation without exploitation! A focus on exploration must not obscure an essential truth: only final exploitation succeeds in creating value!

– There is still a blue ocean to discover, that of true collective intelligence. Some authors, including us, have paved this path... that we would like to explore... with you.

3.6. 2017, Toward future explorations

These initiatives continue to live and grow in 2019 within this network of consultants who have become friends. You too can participate in the pleasure of exploring to find value. It is for this purpose that we provide you with the contact information for individuals and companies below:

– Bruno Stévenin: Director of Management Learning & Development, Michelin Group until April 2017, now a consultant;

– Éric Dépraetere: Michelin Reinforced Materials R&D Director, pilot of the EX² Innovation Management Program. Since 2016, Managing Partner at AUKI;

– Pierre Dhuy: EDHEC Professor, Sorbonne Celsa, Founding Director PH8 Innovation consulting;

– François Raffin: X Télécom, Founding Director in 2014 of AUKI an innovation consulting company;

– Brice Ruel: Managing Partner at AUKI.

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4

A New Progress Technique in the Himalayas

4.1. Introduction

In the Himalayas, the highest peaks in the world are the scenes of spectacular climbs, in a particularly extreme environment.

Himalayan carriers, base camps, oxygen masks and fixed ropes inhabit this very particular world and the homo sapiens we imagine are most often urban dwellers in this context. In high altitude, between rapid incursion and progressive immersion, there are situations of rare intensity. In the way these giants are approached, several travel strategies are possible: in terms of continuous progression or with trips back and forth to the base camp. In the context of continuous progress, the need for "doing together" requires a disruption of the entire organizational chain, logistics, management skills and participants' support. With the combined challenges of safety and pleasure, it is a progression that today challenges the Himalayas and offers exciting life experiences and topics for study.

4.2. The Himalayan technique, a reference

In the Himalayas today, the vast majority of expeditions use a sawtooth style of progression. From a base camp, the Nepalese team sets up high altitude camps that are used by mountaineers/clients in several round trips during the acclimatization period. Then, when all the camps are set up and supplied, the mountaineers wait at the base camp for *the* right weather slot and the summit is attempted in an incursion at the shortest possible altitude. This strategy generates physical and psychological

Chapter written by Paulo GROBEL.

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trauma due to significant stress on the body due to changes in altitude. The difference in altitude between each camp is significant, from 800 to 1,000 m, due to the requirement to install as few as possible and reduce the cost and effort of equipping the mountain. The scattering of climbers on the mountain poses problems for group management, in terms of safety, isolation and decision making. In addition, the amount of equipment – one set of tents per camp – requires a lot of carrying. But it is the most used method of progression, especially for commercial expeditions, supervised by guides whether Western or Nepalese.

All Himalayan literature is thus imbued with the notion of suffering – to the point that it shapes our Himalayan imagination.

4.3. The emergence of new strategies

Noting that these many round trips between base camp and high altitude camps were traumatic for their clients, some guides imagined other ways to approach ascents in the Himalayas. In the 1990s, a French high mountain guide, Jean-Pierre Bernard, proposed the step-by-step method (progressing his group at the same pace, without going down to the base camp), and successfully tested it on the Kun in India, on the Denali and on the Khan Tengri. In 1990, he reached 7,050 m with his clients at Shishapangma on the 20th day of ascent and reached the summit two days later.

Was by preparing the ascent of this same summit that I was inspired by the step-by-step method, but with another intention, to go slowly to acclimatize myself as best as possible to the hypoxic environment. I had a lightbulb moment the year before at Ninchin Kangsang, a 7,000 high peak near Lhasa. An experiment almost by chance:

> "Persistent bad weather had forced us to set up many more high altitude camps during the all too rare moments of respite. Very surprised, we all reached the summit on the first day of good weather, and in great shape!"

Then it was the Shishapangma's turn:

> "At the Shisha, the idea was to use skis, but no altitude carriers, so no oxygen or fixed ropes. When we left the base camp with our house on our back, we greeted our cook one last time by proposing a meeting 15 days later. He laughed as he shook our hands with a thundering 'no problem, see you tomorrow!' Like many others, he didn't believe for a second in our progress technique. But we found him again, 16 days later, the summit successfully in the bag".

These successes have radically challenged a central preconceived notion of Himalayan practice enunciated by the entire medical and scientific community: it is impossible for humans to live at high altitude.

4.4. But also, listening to the doctors' recommendations...

Altitude specialists have always recommended limiting the altitude difference to 400 m between two consecutive nights above 3,000 m. Almost no team respects this simple rule, which is considered too restrictive. And this is precisely what is done as part of a gentle progression that allows the human body to adapt to the constraints of altitude, through a rational management of effort, while allowing time during the day to rehydrate, rest and be together. Within the group, everyone respects the altitude constraints, while taking the time to learn to answer them in order to find pleasure and more success. What does this mean concretely?

Climbing completely independently from the base camp means that the team progresses to the top by moving from camp to camp, without going down to the base camp. Several summits, including two 7,000 m ones in India, can be climbed in this ways: the Chong Kumdan and the Mamotsong Ri, climbs that require commitment due to their remoteness, and many others such as the Gurkarpo Ri, 6,898 m in Langtang, the Manaslu, an 8,000 m summit, or the Himlung, the 7,000 m most frequented in Nepal.

In spring 2008, seduced by the reflection, the questioning of the establishment and previous experiences, François Damilano, also a high mountain guide, accompanied me to climb the Putha Hiunchuli at 7,250 m. This Dolpo summit was the first 7,000 m for all our clients. The route is technically simple, but climbing a 7,000 m is never an easy undertaking. We were fulfilled: being all together on the same day at the summit is a great success. Above all, we lived (and did not just survive) 10 days in complete autonomy, at high altitude, with a pleasure rarely experienced on a Himalayan summit.

François made a film on this atypical ascent, which was widely distributed and had a lasting impact on people's minds. Several articles appeared in specialized magazines and a report on the Manaslu in gentle progression was distributed to the international mountaineering community by Petzl in its equipment catalogue.

4.5. "Doing it together"

The difficulty of living together at high altitude is very real. This obligation to "do it together" is even the challenge of the expedition, and this is what we once

again achieved at Manaslu. Staying together is about solidarity. It is a factor of safety and moral comfort in a beautiful but uncomfortable environment.

"Doing it together" also means progressing roped to one another rather than on fixed ropes and everyone for themself. "Being together" creates a link and a particular meaning to Himalayanism, very close to the experiences lived in the Alps. Systematic doping through the use of oxygen was also refused.

And "being roped together" extended into the evening, organizing to melt the snow, cook and structure a sense of real life at altitude. *This was a trip to the mountains rather than a round trip. An immersion rather than an incursion.*

Limiting daily efforts to 4–5 h of travel, reducing the distance of the stages and increasing the number of camps are revolutionizing Himalayan practice, and changing our expedition philosophy to one of continuous progress. "Go to the high seas for a crossing that may or may not pass through the summit. And much later, come back to the port". This symbolic departure forced us to reconsider the slightest of our actions, give the maximum attention to the preparation and plan the right food to better experience what is more like a journey to altitude than a simple ascent. New tools such as telemedicine and weather forecasts communicated by satellite telephone made it possible to improve the management of these trips at altitude, to really enjoy the time spent "up there", at altitude, as a source of pleasure.

4.6. Snail strategy, gentle progression, slow expedition, continuous progression?

4.6.1. *Toward a name change*

From the very beginning of this Himalayan adventure, the choice of a name to clearly identify this "new" progression was at the heart of our discussions. In the spring of 2007, at the Shisha, we first used the name Jean-Pierre Bernard had chosen, i.e. *the step-by-step progression*. But very quickly, it seemed necessary to us to express our difference, our particularity.

Jean-Pierre's team progressed on foot by using mini pulkas to transport the equipment and food necessary for the duration of his trip, without going back and forth between the camps and with the objective of achieving the summit in a minimum amount of time. The travel technique was very similar to that of polar expeditions.

On our side, we progressed on skis, but carrying our belongings on our backs, continuously, without returning to the base camp, but with some back and forth

between the high camps. We calibrated the transported load to 12/15 kg with one or two intermediate carrying routes to set up our camps. We also tried to comply with the recommendations of the medical world by limiting the difference in altitude between two camps to around 300/400 m.

The two teams did not have any altitude carriers, which is remarkable for a supervised practice on an 8,000 m climb.

4.6.2. *We have therefore named our strategy "progression douce" (gentle progression)*

It was a question of expressing a very particular choice of life and movement in the Himalayas, an immersion in the hypoxic environment.

The gentle progression marked a real break with the logic of the ascents under way in the 1990s, characterized by the effort and suffering maintained, valued and claimed that permeated all the stories and reports on the Himalayas. This form of practice is still the most popular today!

But with this name of *progression douce*, we quickly encountered the difficulty of translating it into English to reflect our experience in the international mountaineering community. Thus I continued my experimentation and the gentle progression imposed itself on my practice.

In spring 2008, the expedition to Putha Hiunchuli was the material of a film on the *progression douce* shot by François Damilano. It was a very beautiful expedition marked by rare success, "all together at the top!". The name François chose for his film, *La stratégie de l'escargot* (the snail's strategy), expressed the notion of autonomy, of carrying our houses on our backs. It was also a form of jest that left a lasting impression on people's minds, but also caused rejection, derision and denigration, aggravated by the resolutely out-of-field nature of the exploit that characterized the Himalayas of the time (but still today).

4.6.3. *The gentle progression has become "the snail's strategy"*

Later, reading the book *L'éloge de la slogue*, on the worldwide slow attitude movement, allowed me to put our practice into words and to bring it closer to a more global philosophy.

Our friendly Himalayan gastropod has thus left the world of sporting achievement to join that of psychology and personal development. What a leap forward!

4.6.4. *The snail strategy has been transformed into a slow expedition*

With a return to the use of the name *progression douce*, to give it more meaning, a reflection on non-categorization also allowed me to put all these names into perspective.

In 2015 and 2016, during the expeditions to the Himlung Himal, we encountered other expeditions to the base camp and during the ascent. Our unusual progress caused surprise and tension between the Nepalese teams, who then spoke of "Paulo style". As this is absolutely not what I wanted, it therefore seems to me today necessary and indispensable to change the name again.

4.6.5. *Slow expedition now becomes continuous progress*

The term can also be easily translated into Nepalese English as *continuous style*. For the Nepalese, it is the continuous nature that is directly visible and makes the difference that makes sense. And it does not matter if, by the way, the philosophical notion of slow attitude is discarded. In any case, it has few echoes in the universe, the questioning or representations of the Nepalese or in the values conveyed by other expeditions of all nationalities. It is simply enough to add a complementary denomination to qualify the way of doing things or to claim to be part of a particular movement – speed or slow.

This name change is also a desire to simplify the name, the definition of progression techniques in the Himalayas with, on the one hand, sawtooth progression or Himalayan technique and, on the other hand, continuous progression or alpine technique.

The objective is also to be able to qualify and speak clearly about the different levels of practice: high level or ordinary mountaineering, professional or amateur, and to facilitate a comparison.

Today, our progress during the expeditions I organize is primarily based on the alpine technique, valuing both a continuous progression and a rope progression. Then, the notion of a gentle progression in a slow expedition is a concept that completes this qualification.

4.7. Not to conclude....

In spring 2017, it was the fifth time I went to the Himlung. I was particularly looking forward to going back there.

This may seem very strange for someone whose Himalayan signature is rather exploration, the discovery of new routes and cultural and geographical decoding. Returning several times to the same summit, in the same region, is also a form of exploration, a questioning, a search for more quality and pleasure. It is certainly a research process.

It allows you to focus on a specific subject during a time-limited expedition, then to shift your attention to another object of study in the next expedition. It is the idea of taking a specific field further and taking small steps forward (the notion of *Kaizen* in Japanese), but also of writing on the subject to share it and confront it with the opinions of other benevolent and critical people.

In spring 2017, we returned there to experience a crossing from a high peak at more than 7,000 m by a team of amateur mountaineers and as part of a commercial expedition. We also returned with our Nepalese companions who will one day be guides, so that they could learn from and share our experience.

SECTION 3

Toward an Extreme Ethnography

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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5

Some Methodological Considerations in Relation to the Objects Involved

Over the past few decades, anthropology has been open to areas of contemporary society on a massive scale, and more particularly to so-called sensitive or crisis areas. These areas can refer to spaces (camps, ghettos, slums, etc.), groups (foreigners, migrants, refugees, unemployed, etc.) and social conditions (social marginalities and exclusions, economic and political inequalities, etc.). They concern both situations of discontent and distress (victims of diseases and epidemics, structural violence, etc.) and extreme experiences (ecological disasters, wars, risky behavior). Doubts and methodological hesitations have arisen from these fields, in particular the central question of the researcher's legitimization modalities, their relations with the various institutions operating in these fields, the collaboration and restitution of the results to the different populations or groups concerned, and finally the anthropologist's loyalty and ethical and civic commitment (Agier 1997; Le Palec and Luxerau 1999; Naepels 2004; Bouillon *et al*. 2006).

Contrary to the traditional perspective of anthropology, which required the researcher to ignore themself, to keep silent about any emotion in order to establish an objective relationship with the realities they were studying, to conceal the way in which they had negotiated their presence in the field, to pay little attention to the effects of their work, the new anthropology is concerned with reintegrating these different dimensions into the production of knowledge and thus to recognize the anthropologist as a full actor in the investigation situation. It is now a question of considering how prejudices, political commitments and the gender of the researcher, in particular, guide the investigation and influence the understanding of the realities investigated (Fassin and Bensa 2008), how the anthropologist's personal journey, or even intimacy, are part of the ethnographic relationship and affect their research and

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Chapter written by Mondher KILANI.

writing (Defreyne *et al.* 2015). Similarly, several anthropologists' reflections focus on emotions as a guide to better understand the ethnographic context and especially the role of the ethnographer in the ethnographic situation (Kleinman and Copp 1993; Lantz and Sélim 1995; Mazochetti and Piccoli 2016).

In fact, these new fields act as a magnifying glass of situations and practices encountered on more ordinary, more classical fields, but hidden by the canonical representation of work in the field. The latter was characterized by a double closure, spatial and temporal, based on a static and homogeneous representation of social groups, favoring order and balance, structures and functions. In traditional anthropology, methodological developments corresponded more to *a posteriori* constructions, to a representation of the anthropologist's practice in accordance with a positivist vision of research, than to a description of the processes of knowledge production in the field (Kilani 1990). More precisely, with the standard ethnographic genre, we were dealing with two types of texts: on the one hand, a textual representation corresponding to the scientific text itself and presenting a smooth surface from which any presence of the researcher in the field was erased: it was the neutral and monological scientific "we" and the collective and homogeneous "they" ("the Nuers", "the Bororos", "the peasants of the Bocage", for example). On the other hand, there was an "hors-texte" (off-text) in which were recorded in bulk the procedures of discovery of the object implemented and the personal reflections on the field experience. It was the narrative of the field and/or the intellectual journey (for example Lévi-Strauss and his famous *Tristes Tropiques*, 1973), the diary in the strict sense of the term (for example Malinowski and his no less famous *Journal d'ethnographe*, 1985) or the methodological introduction (for example, Cresswell and Godelier 1976). The "hors-texte" represented in a way the "cursed part" of the discipline that must be reintegrated into scientific production (Lourau 1988; Perrot 1989; Mercier 1994; Kilani 1999).

With the new epistemological concern of anthropology, the question arises as to what is the status of the famous rule of participation-observation which, formulated in this way, appears to the layperson as a strange oxymoron. From the new field, the participating observation of classical anthropology, which is supposed to ensure both involvement and neutrality, tends to be reversed into "observing participation" (Fassin and Bensa 2008), and to transform the anthropologist through the field (Anthropologie et sociétés 2011). In the same vein, failures and errors experienced in the field have become heuristically relevant. They have become involved in the construction of the object (Geertz 1983; Jeudy-Ballini 1994). In short, the question of the distance to be established between oneself and one's "object", which has always been a challenge in empirical work in the field and later in interpretation and textualization work, needs to be discussed again (Kilani 2000).

At present, the anthropologist's exteriority in relation to the group or environment in which they conduct their work is no longer considered as a guarantee of objectivity, and by extension of scientific rigor. In fact, it has never been: it was at most an objectivist illusion inherent in the standard scientific approach (believing that it is enough to be from the outside to ensure an objective view). Today, as it is more and more common to conduct "native" research, i.e. in the context of "home", the question of distance obviously remains crucial. It arises with as much acuity as in the case of working on distant and "exotic" objects. In other words, the problem does not simply stem from a simple geographical or historical distance from the object studied, but refers more fundamentally to a heuristic dimension, involving the place of the researcher in their research and the awareness of it.

For a long time, the intersubjective dimension of the research situation has been forgotten (Mohia 2008). However, this is the very condition for an inter-comprehension between social actors. The researcher's knowledge depends not only on their position in relation to the research object but also on the type of interaction that takes place with their informers. Deirdre Meintel (2016) thus speaks of an "experiential" anthropology, one that involves the body and emotion in particular. In such an anthropology, field experience becomes the very process of constructing ethnographic knowledge, a knowledge in itself. Such a perspective highlights the difficulty if not the impossibility of a non-engagement of the "body and soul" in the investigation situation, as noted by Loïc Wacquant (1994), author of several studies on extreme poverty. This underlines the need to include, for reflection, one's own affects and emotions, and one's own movements and feelings. The latter are not only complementary to the observations and stories collected in the field, they are also part of it.

Researchers from Louvain-La-Neuve, Belgium (Mazochetti and Piccoli 2016), recently published an issue of *Parcours anthropologique*, a journal published in Lyon, entirely devoted to the following theme: "ethnographing intimacy, silence and situations of violence", with the main concern being the "methodological, ethical and emotional challenges" of research. In this issue, the various contributors took as their object of reflection the "experiences and emotions" that result from "situations of great suffering and trauma that have deeply affected the subjects" (Mazochetti and Piccoli 2016, p. 4). They tried to understand how the researcher manages, beyond the silences, to "grasp and decode from their own affects and emotions what deeply upsets the other"; how, "listening to their emotions, they then access the impossibilities to say by using small touches to communicate" (Mazochetti and Piccoli 2016, p. 4).

However, the sharing of such emotions or values can blur the line between the biographical experience of the "analyzed" and the ethnologist's experience. This raises the question of the "right distance" to be found to objectify the overall

experience of the investigation. But the opposite is also true: "a field of profound disagreements in terms of moral values makes the ethnologist's work just as complex" (Mazochetti and Piccoli 2016, p. 5). The latter must thus redouble their reflexivity, by seeking to clarify their own underlying "value system", which is undoubtedly decisive in the way the individual conducts the investigation and establishes their relationship with the other.

Let us take the example of the political and ethnological scientist Martina Avanza, from the University of Lausanne. She investigated Lega Nord activists, whose xenophobic feelings toward immigrants, ostracism toward other Italian citizens in the center and south of the country and lack of interest in economic equality are well known. In the preface to her research, Avanza (2008) points out that while the problem of "right distance" is inherent in any ethnographic investigation, this question arises with greater force when the ethnologist must conduct a "participating observation" with people who "politically represent everything they hate" (Avanza 2008, p. 41). She also points out that relations with informants can be difficult even when the ethnologist maintains a close relationship with them. What about the right distance, between the investigator and the respondent, when it comes to a particularly difficult terrain, where they do not share the same values?

It thus returns to the question of "empathy toward the group studied" (Avanza 2008, p. 42), which has always been considered by anthropologists, let us recall, as the very condition for fieldwork, and whose absence of demonstration was considered in this respect "as a real professional misconduct calling into question the quality of the investigation itself" (Avanza 2008, p. 42). What about her own stance toward the Liga Nord, from which she was far removed in terms of values and political commitment? What desire could she have to "collaborate" with such a movement, or even to contribute, through the interest she has in it, to "rehabilitating" such a "detestable" party? Finally, how can we establish intellectual, emotional or moral relationships with interlocutors "who represent everything that politically revolts you?"(Avanza 2008, p. 43).

Therefore, investigating another person who "repels" you, politically or morally, not only implies an effort from oneself, but also introduces the possibility of being instrumentalized by respondents who "try to give their own definition to the ethnographic relationship by turning it to their advantage" (Avanza 2008, 44). This difficulty is not, however, absent from the situation in which respondents resemble us, or for which we have sympathy, or even empathy, but whose unwanted effects on us may be more easily controlled. In the case of "repugnant" or "revolting" objects, we should, according to Avanza (2008, pp. 54–55):

> "... uncover mechanisms that often remain underlying in 'empathy' investigations. Ethnographers working on movements with which they feel empathetic (anti-globalization mobilizations, feminist struggles, political commitment of indigenous groups) are not forced to ask themselves with the same sharpness the questions I have been forced to confront: what is the nature of my 'alliance' with my indigenous people? What do they expect from me? Why, as an ethnologist, do they take my sympathy for them for granted? What kind of uses do they make of my knowledge? These questions are as much methodological questions inviting the ethnographer to objectify their position as they are sources of knowledge about the group studied".

Thus, the encounter is not only physical, a simple face-to-face encounter, a temporary coexistence in time and space. It is also not only a methodological relationship, a set of procedures and rules to which the researcher must comply; it is more than that in that it also depends on the place occupied by the researcher in the investigation situation and more broadly in the social networks surrounding them. As Mazochetti and Piccoli (2016, p. 5) note, "with time and the relationships that are established, the researcher is invested as much as they investigate and invest in some of the people in their field, sometimes becoming a part of their life". The question is what to do with these parts of life experienced during the investigation situation, as well as what to do with them both in the production of knowledge and in the pursuit of a life elsewhere.

Such a posture implies getting rid of a certain voluntarist vision of work in the field, a rationalist vision of this practice in which the ethnologist masters or should master things and people from beginning to end. As Deirdre Meitel (2016) suggests, following the Dutch anthropologist Johan Fabian (2001), we should move "towards letting go, essential to the production of ethnographic knowledge where the researcher puts aside their control mechanisms, their program and their objectives". This is precisely what François Laplantine (2016) proposes. The researcher must, according to him, be able to enter into "a process of divestment and non-assertion of self". They must ensure that they "allow it to happen, not intervene (too much), not sort through perceptions". This movement, which he calls *wu wei* and which he borrows from Chinese philosophy, reflects "a diffuse attention that is not focused, not precipitated, not stopped and blocked on a particular perception. (...) Consciousness unloads itself from all intentionality, all purpose, all premeditation" (Laplantine 2016). This helps to avoid the failure to "anticipate a position" that would thwart the flows that circulate in the investigation situation. We must therefore learn to relinquish, to turn our backs on the obsession with collection and accumulation, in short, the total control of our terrain. According to Laplantine (2016), the attitude of *wu wei* corresponds to the following posture: "we do not strictly speaking pursue a goal, we do not aim for a result, we do not seek to attract,

capture, control, seize and take but to take away from this vectorial position which is that of conquest". In other words, an "observation by impregnation" must replace "an observation by concentration and fixation". It translates into "availability for the event".

What prevailed in classical ethnography was the function of seeing. The see/knowledge couple was at the heart of the production of knowledge. It was to the detriment of emotion and impregnation, involvement and intersubjectivity. However, we should not be satisfied with just seeing, with the attitude of thinking that "only what we see that necessarily lies ahead exists" (Laplantine 2016). We should also let ourselves be seen, let ourselves be "looked at by the other". As Laplantine also points out, "what is watching us is likely to call into question the unidirectionality" of our own view, oriented toward action, accumulation and result. What is watching us contributes to placing us in the situation of "welcoming" rather than in that of "collecting", it makes us attentive to the "researcher's dispositions" rather than only to the "objectification devices". Laplantine introduces an interesting metaphor to differentiate between the traditional approach of the ethnographer and the new position that must go beyond it. This is the "rhythmic pulsation of breath". According to him: "Positivist ethnography does not breathe enough. It is arrhythmic and foreign to the movement of living beings made up of ebb and flow, features and withdrawals, appearance and disappearance, whereas this very movement is likely to inspire the method" (Laplantine 2016).

From this point of view, it is interesting to see that this renewal in terms of method has its corresponding items in terms of concepts and categories of anthropology and sociology. This concerns in particular the notion of society itself, the critical assessment of which we have presented in the book *Anthropologie. Du local au global* (Kilani 2012) and from which we take up the main point here. Sociologists and anthropologists have thus wondered whether this concept is still relevant to analyze the contemporary world (La Vega 2005; Sciences Humaines 2005), whether it has not run its course. It only made sense in the context of "banal nationalism", which assumed that social practices took place within closed borders that formed a system (Urry 2005). The focus of the social sciences on the notion of society corresponded to a first form of modernity, which was concerned with systems where individual practices were guided by rigid social norms, by disciplinary mechanisms (Foucault 1975), and only became meaningful in relation to the roles they performed in the "social organism". Today, we would be living in a "second modernity" (Bauman 2004), marked by the decline of "closed" institutions such as schools, families, hospitals, the army or companies, by the indecision of authority figures and by the decline of hierarchies.

Unlike the old industrial societies, social constraints have become more fluid and relationships have intensified. Sociologist Anthony Giddens (2000) speaks of

"stretching" with regard to relationship between local and planetary events. From an old society that could be described as "solid", we would move to a new one that has the properties of "liquid", to use Bauman's (2004) metaphors. Others use the term "rhythm" (Michon 2007) to describe how individuals relate to institutions and how they build and maintain social, economic and political relationships. The classical notions of system and structure, reflecting the stability of the ancient world, would be ineffective today. The classic metaphors of "force", "field", "social body", "infrastructure" and "superstructure" should be replaced by those of "connection", "flow" and "network". These metaphors would give greater importance to contingency, unpredictability and mobility.

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6

Ethnography of the Extreme: Epistemological and Methodological Issues of the Use of Video

6.1. Introduction

Within the framework of the research program "*Management des situations extrêmes*[1]" (Lièvre 2001, 2004, 2016), various methodological issues have rapidly emerged (Lièvre and Rix 2003). To study the modalities and principles of organization, including those of polar ski expeditions, it was necessary to invest actual practices in their specific context, "the organizing as it unfolds" (Van Maanen 2011). Since then, ethnography became a particularly relevant method of investigation (Yanow 2009; Ybema *et al.* 2009; Van Maanen 2011; Watson 2011; Lièvre and Rix-Lièvre 2013; Rouleau *et al*. 2014). Indeed, participant observation makes it possible to approach actual practices and their underlying principles without limiting oneself to "verbal, voluntary and intentional communication, [... which] is especially inappropriate to provide information on non-verbal and involuntary aspects of the experience" (Favret-Saada 2009). It is immersion in a community that allows the study of effective practices and promotes their situated understanding. A detailed understanding of the design and unfolding of a particular polar expedition, for example, requires studying it in all its singularity and reporting on its specific course. However, from a more anthropological perspective, it is a question of starting from the understanding of singular practices to a modeling of modalities and organizational principles in an environment qualified as *extreme*.

Chapter written by Géraldine RIX-LIÈVRE.

1 The management of extreme situations

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This modeling then aims to provide benchmarks for actors in the conduct of this type of collective action.

But we still have to define the *extreme*. A recent literature review (Hällgren *et al.* 2018) proposes to answer the question "what are extreme contexts?". If it leads to a classification distinguishing "risky contexts, emergency contexts, and disrupted contexts", it seems to us first and foremost necessary to distinguish extreme contexts, on the one hand, from extreme situations, on the other. The former are defined from the perspective of the observer who, in relation to cultural, scientific and technical benchmarks, identifies in a particular environment significant physical, psychological and/or material risks to the organization and its members (Hannah *et al.* 2009). In other words, the extreme is related to the environment and its specific characteristics; thus, it is considered as evolutionary, uncertain and risky (Bouty *et al.* 2012; Lièvre 2016). It is events that can cause physical, psychological and/or material damage and the potential for such damage to occur in relation to the ability of organizations to prevent it that are at the center of the definition of an extreme context (Hällgren *et al.* 2018). The latter are defined in relation to a person engaged in a particular context: a situation refers to what is significant to that person here and now (Récopé *et al.* 2011). The extreme character then depends on the coupling between a particular context and an actor; it is enacted. What is then considered is the "part of all dynamics in the environment which enter as perturbations into the domain of relevance to the organism" (Weber and Varela 2002, p. 118) as pointed out by Récopé *et al.* (2014). Thus, a situation can only be described as extreme when it is experienced outside the framework of daily experience by the actor involved in a particular project (Hurley-Hanson and Giannantonio, 2013). The situation is extreme only in reference to an actor's own norms, because it is them who gives the situation a positive or negative valence (Récopé *et al.* 2011).

The distinction made leads to the consideration of convergences, differences but also articulations between modalities of organization and the regulation of collective action in extreme contexts, on the one hand, and in extreme situations, on the other. From a methodological point of view, it also generates different orientations.

If ethnographic work focuses on *organizing* in extreme contexts, it is to be integrated into a community of actors, firefighters, polar explorers or operators of a High Reliability Organization (HRO) to study their daily practices in an *ordinary extreme*. Technically, culturally, socially, the context in which collective action takes place is designed to potentially affect the health and safety of people, property and/or organizations. However, the actors perform daily in this environment; they implement procedures and techniques that are ordinary from their point of view, routine even.

If ethnographic work focuses on the ways in which collective action is regulated in extreme situations, then it is essential to consider people's activity first and identify what causes a disruption, what is experienced as abnormal, and what is imposed on the actor as evolving, uncertain and risky. Moreover, if the risk relates to (a) potential losses, (b) the value or meanings of these losses and (c) the uncertainty associated with these losses (Yates and Stone 1992); then by capturing what is risky for people in extreme situations, it is possible to understand what is important to them, what organizes their activity and what they engage to deal with these potential losses (Récopé *et al.* 2008; Récopé 2019). The challenge is then to identify extreme situations for the actors and to study their practices during the corresponding moments.

While it is important to distinguish between extreme contexts and extreme situations, particularly with regard to the methodological issues that concern us in this chapter, it must be agreed that the extreme contexts, sensitive or crisis areas mentioned by Mondher Kilani in the previous chapter, remain favorable to the study of extreme situation management. The researcher must then redouble their methodological reflexivity since, immersed in an extreme context, they can experience the situation as extreme while the people in the community studied do not experience it as such or vice versa. Far from being a bias, this discrepancy can be heuristic from a methodological point of view during ethnographic work that is both involved and involving.

6.2. An involved and involving ethnography

Various research projects conducted as part of the "*Management des situations extrêmes*" program are based on ethnographies conducted in extreme contexts: polar ski expeditions (Rix-Lièvre and Lièvre 2010, 2014; Lièvre and Rix-Lièvre 2013), fighting forest fires (Gauthier 2010), simulations for Martian exploration (Bonnet 2015), etc. As Mondher Kilani points out in Chapter 5, ethnography, particularly in these contexts, requires a strong involvement of the researcher in their field. The various *Doing Research in Extreme Contexts* workshops (Montreal, Canada; Umea, Sweden; Paris, France) also testify to the researcher's necessary commitment within the community. Their participation in initiatory rites, their help (however minimal it may be) at a critical moment or the adequacy of their position to the stakes allow the researcher to find a place in the community and to ensure the possibility and continuity of the field work. It is indeed a "body and soul" commitment (Wacquant 1994 in Kilani 2019) where immersion can become submersion, especially when the researcher experiences situations as extreme. Kilani (2019) demands this letting-go, Laplantine (2016) the being absorbed- or Favret-Saada (2009) the being-affected, but the submergence in an extreme context is likely to jeopardize both the investigation and the actors' project, or even their safety. It seems important to

anticipate the researcher's position within the community studied. As Monique Aubry points out in this book, in this type of context, adaptation is not contradictory to planning; on the contrary, planning is a real support for adaptation, availability to the event, creativity (Aubry and Lièvre 2010). Thus, to echo the proposals of Laplantine (2016) and Kilani (2019), we risk anticipating different positions in the group, one to approach the activity of certain actors in extreme contexts or extreme situations, the other to understand the modalities of collective regulation throughout a project (Rix-Lièvre and Lièvre 2010; Lièvre and Rix-Lièvre 2013).

While a more or less committed position in the realization of the project, more or less naive within the community, is anticipated, it is not applied (Rix-Lièvre and Lièvre 2010, 2014). The unexpected situation facing *in situ* researchers is constantly changing their position. It is not a question of considering this transformation as a bias; the anticipated position is essentially a tool for reflexivity during fieldwork, but also during writing (Rix-Lièvre and Lièvre 2014). This tool helps to update the researcher's position in the group as the fieldwork progresses, or rather their positions according to the circumstances and the history of their participation. This effort is central to understanding the practices that community members accept sharing as well as the addressing of their discourses. It is an essential reflexivity to take into account *what concerns us* (Laplantine 2016) or rather *those who interact with us* and how they do it as well as *what it does to us*. Taking into account the circularity of the gaze is thus necessary in order to position the materials constructed and the related interpretation in relation to both the "value system" underlying the way in which the researcher conducts the investigation and builds their relationship with the other (Kilani 2019) and the place that the latter gives them. This positioning allows us to put into perspective the extreme or non-extreme nature of the situation for the different actors and for the researcher; it is a condition for the difference between the ways of experiencing an event to become heuristic and to approach the determinants of an extreme situation for each one and to understand their activity.

Moreover, if the fieldwork requires availability for the event, a real sensitive, physical and cognitive commitment, not abandoning the research project implies the development of tools and methods for the construction of materials. These materials must first allow the researcher, as Favret-Saada (2009) points out, to act in a way that community members consider appropriate. Staying involved in a community implies, especially in extreme contexts, not disrupting the project and/or the action of its members while participating in it. The materials constructed contribute to the understanding, often intuitive, of what others expect from us and allow us to act accordingly. These materials are also a resource for the researcher, so they can look back at how they experienced the events. If reflexivity implies distance, it is also a question of building enough traces to be able to describe, to explain, *ex post*, one's own experience during a particular moment. Finally, the materials must be a support for the construction of knowledge on the actual practices of the actors in extreme

contexts and extreme situations; distinguishing their practices and what organizes them in moments experienced as risky, uncertain, evolving and at odds with their daily lives, and in those that are not experienced in this way. To this end, as part of the research on polar expeditions, video has quickly established itself as a relevant tool, not only for investing in everyday social activities (Heath *et al.* 2010), which are part of an extreme context, but also for studying the activities of different actors and organizing them in extreme situations.

6.3. Interests and limitations of the use of video in the production of materials

Before becoming a tool for building materials, video, in many contemporary areas of practice, including polar expeditions, is a technology widely used by community members. There are many films relating the progress of a particular polar expedition, probably countless rushes made by explorers, whether they are simply intended to be shown to relatives or used for communication purposes[2]. The researcher's use of video is not inconsistent with the actors' practices and does not create distance or mistrust. In this context, filming is a matter of course. The making of recordings can also be a contribution of the researcher to the expedition. In other contexts, particularly those that Pascal Lièvre, in the introduction to this book, describes as non-intentional, hostile, threatening or even critical, the use of video could be more debatable, intrusive, voyeuristic, inappropriate... Thus, the interests and limits of the use of video in the production of materials cannot be discussed without being recontextualized both in relation to the practices studied and the place of the researcher in the community, in other words, without taking into account the way in which the actors perceive the use of video by the researcher. For example, in the extreme context of refereeing high-level sport, if the footage of the match is largely televised and therefore easily available, the possibility (or not) of filming as well as the mode of registering are largely indexed for the researcher at the heart of the referee community and in the way in which the latter takes hold of the research project.

Video recording, where possible, has at least three advantages in terms of material construction. The first is to restore, at least in part, the singularity of the activity studied. It is a trace of the unfolding of a practice, an event in a circumscribed and specified moment. Noticed or not, remarkable or not, the video inscribes the activity in terms of space and time. Even if the recording is a construction, by virtue of the perspective chosen, the time and its duration, the trace

2 The line between the two being made largely permeable with the explosion in the number of blogs or websites presenting the progress of an ever-increasing number of expeditions.

produced is rich in a multiplicity of interpretations, each of which can consider different elements of contexts, different descriptions of the practice without cutting itself off from the singularity of its actual realization. Although not exhaustive, the video remains rich in documenting different dimensions of practices and events that occur simultaneously. It allows the "co-presentation of central and peripheral details" (Macdougall 2004). This is the second advantage, largely identified by different currents studying ordinary social interactions in detail (Heath and Hindmarsh 2002; Heath *et al.* 2010). The third is the evocative power of video. Indeed, if the video allows the in-depth analysis of an external observer, it also facilitates the re-immersion of the actors at a particular moment in time because of the visual and auditory contextual elements that it reproduces (Rix-Lièvre 2010). In this case, it can lead not only to a reminder of contextual elements, but above all to a return to significant elements of the situation. This re-immersion opportunity is also based on the temporal dynamics of the trace; it inscribes the activity and events in a temporal flow.

Nevertheless, the use of video tends to introduce, on the one hand, a factual drift and, on the other hand, an impression of transparency. As the process of building the video fades away in front of the strength of the image presented, the latter is often considered as the restitution of facts. Merleau-Ponty's conclusion on perception is as follows: "the emergence of a true and exact world" whose influence conceals the very process of construction (1945, p. 65) and is reinforced by the fact that perception is mediated by a concrete and lasting artifact: video. Thus, there is a great risk of considering that what is shown constitutes a factual, indisputable and obvious reality and thus forgetting that video is nothing more than a point of view constructed relatively for purposes that need to be explained. In other words, while ethnography has largely abandoned postpositivism, the use of video, under the guise of apparent modernity, could lead to a reckless backtracking. It is therefore essential to remain vigilant about how constructed video materials are considered and processed during research. In addition to the possible factual drift, the impression of transparency is added, according to an identical process. Since video tends to impose itself as a representation of a tangible, obvious and factual reality, the presenter is often convinced that if their audience looks closely, they will see what is happening. Yet, according to a relational and enactive ontology that Michel Récopé develops in this book, faced with a video, as in any context, perception is an active process, inseparable from a person's commitment. What is significant, *meaning*, as he points out, corresponds to the way in which an actor spontaneously grasps their world. Thus, the video shows nothing in the sense that it does not determine what is captured or what appears for this or that person. It can become a material to describe and to show but it supposes that to do so is to be, like any other material, processed and shaped. The trace it constitutes does not offer an immediate understanding of what is at stake in the filmed moment. It is finally the immersion in the field, the involvement of the researcher in the community, that promotes a situated

understanding of effective practices, since video is only a material to approach the situation and the foundations of the actors' activity, as Heath and Hindmarsh (2002) also point out. It is not only the visual aspects that are targeted by the ethnographic use of video, but these aspects are only a "pathway to the non-visual aspects of the human experience" (Macdougall 2004). It is therefore an illusion of transparency that must be fought against as an epistemological obstacle (Bachelard 1977).

Thus epistemologically positioned, the uses of video to study "the organizing as it unfolds" in extreme contexts and extreme situations can be multiple: the objectives, construction and processing modalities must therefore be specified.

6.4. Video, a modality of ethnographic writing

As Macdougall (2004) shows, the uses of video in ethnography evolve according to objects, paradigms and therefore eras. He emphasizes above all that video is a means of exploring social phenomena, but also of expressing anthropological knowledge. According to him, video recreates the living nature of these phenomena. It places these said phenomena in a unique context, thus promoting the expression of their diversity. It allows a syncretic apprehension of the moment by showing different shots simultaneously by delivering a multiplicity of details. It is a *medium* that counterbalances the influences of the verbal and the text in the study and understanding of practices. The video *in fine* proposes another way of recognizing practices, more experiential, more intuitive, by acquaintance, as Macdougall (2004) proposes in reference to Russell. Thus, what is recognizable is not limited to the visible, but encompasses sensitive, affective and relational dimensions. What Macdougall considers to be an added value for anthropology raises important epistemological questions: what is the scientific validity of film production? Without naivety about the constructed character of the video and positivist consideration, the questions asked are related to the polysemy inherent in film production; polysemy likely to open up, as we mentioned in the previous section, to different understandings, some potentially ethnocentric. The other major issue concerns the difficulties (or even impossibility) of proposing theorizations, generalizations and conceptualizations via video. In other words, how can the scientific legitimacy of a researcher's film narrative involved in a community be considered?

Within the framework of the *Management des situations extrêmes* program, part of a constructivist epistemology (Lièvre and Rix-Lièvre 2013), we consider this film production as an intermediate production.

Throughout an expedition, from the idea of the project to its implementation, including the preparation phases, a researcher involved in the realization of the

project produces different traces, in particular video rushes. The objective, established beforehand, is to develop a narrative of the project's progress that is acceptable to the entire collective. Rushs are primarily constructed from the researcher's perspective, according to what is significant to the researcher *in situ*. Thus, some rushs constitute a trace of daily practices and organizational modalities in an extreme context. In particular, they highlight the construction of collective routines. On the other hand, when the situation becomes extreme for the researcher, the scientific project is no longer the main issue (Rix-Lièvre and Lièvre 2014) and the production of video traces is rare. During the polar expeditions investigated, there is no video of a crew member falling into the icy water, of dogs (which provide protection against bears) fleeing or of the time when the waves disrupt the kayak 1 km out from the coast. When these events are perceived as extreme by the researcher, it is a matter of coping, not producing rushs. We have only a few videos produced in extreme situations on the spot. On the other hand, video recording is frequent, almost systematic, to provide "hot" feedback as soon as the situation is no longer extreme. These videos are colored by the researcher's situation: the rushs produced, but also what is not recorded, depend on what is spontaneously significant for them. However, constructing a narrative that is acceptable to all implies reporting on the discrepancies between the situations of the different expedition members (extreme for some and not for others for example) and the temporal recording of convergences and divergences or even controversies (Garel and Lièvre 2010). Thus, the rushs and the film narrative provide information, from the researcher's point of view, on how collective action is organized in extreme contexts and how it is regulated when the situation becomes extreme, at least for some expedition members. The nature of the rushs is not of the same order: a trace of practice in the first case and a trace of an *in situ* reflexivity for the second.

By staging controversies, as well as the temporality of the appearance of convergences or divergences within the group regarding the extreme nature of the situation, the film narrative, or rather multimedia, since it integrates traces of different natures, creates a new reality addressed both to the academic community and to the polar explorers. This narrative thus proposes a focus on the moments of transition from a context to an extreme situation from the point of view of the collective and on the changes in the modalities of regulation of collective activity. This new reality is a resource for the polar explorer community, a resource whose richness lies in the polysemy of the narrative. This narrative, which presents the unfolding of an expedition in its singularity while proposing a particular focus, should allow each explorer to actively construct principles to regulate collective action in extreme contexts and situations with respect to their mode of engagement in the polar environment. The polysemy of video thus becomes an asset in the perspective of developing knowledge for action (Lièvre 2004). Does this mean that scientific modeling is no longer required? If not, what is the status of the multimedia

narrative? We consider it as shaped materials, an intermediate production that allows us to question the legitimacy and theoretical relevance of controversies in order to understand the modalities of regulating collective action in extreme contexts and their transformation when the situation becomes extreme. Indeed, if the narrative centered on controversies allows actors to construct principles for regulating collective action that contribute to the success of an expedition project, then controversies can be considered as a relevant object to design and regulate organizing in extreme contexts and situations. In addition, the comparison of different narratives centered on controversies offers an opportunity to characterize the nature(s) of the controversies, the temporal dynamics of convergences and divergences, the foundations of these dynamics as well as their impact on the modalities of regulation of collective action.

In the *Management des situations extrêmes* research program, some video productions are thus oriented toward the development of a multimedia narrative. The latter shows the unfolding of the expedition and proposes a way of considering the modalities of regulating collective action in extreme contexts and situations. Its implementation is based on the researcher's participation in the project, involvement in decisions about the project's orientations and taking responsibility within the team (Rix-Lièvre and Lièvre 2010; Lièvre and Rix-Lièvre 2013). This multimedia narrative is also oriented according to a scientific problem and concepts; we were referring here to the notion of controversies. It thus constitutes an intermediate scientific output to test the relevance of these concepts in the design and understanding of a polar expedition project. While this use of video during ethnographic work is part of and enriched by research in visual anthropology, others are more marked by work in ergonomics, occupational psychology, sport sciences, focusing on the study of activity.

6.5. Video, for an ethnography of activity

If the multimedia narrative aims to present the entire expedition process by presenting the modalities of regulating collective action, another use of video contributes to the study of the activities of different actors at particular moments in time (Rix-Lièvre and Lièvre 2010; Lièvre and Rix-Lièvre 2013). To study the activity implies to be interested in the effective, spontaneous, singular practices of the actors in their own environment. They must be investigated both in their observable dimension, but also in their unobservable, private, subjective dimension (Vermersch 2004a; Rix-Lièvre 2010; Theureau 2010).

Video is first of all an asset to document the observable aspects of the activity. It constitutes a trace of the actual activity by placing it, as we mentioned earlier, in a particular space and time. This trace allows for several observations of a

phenomenon that remains ephemeral; it could be produced again *in vivo*, but never totally identical since the dynamics of the activity would be modified by repetition. The video thus allows several screenings in order to study in detail the observable aspects of the activity. Depending on the focus of the research, this involves determining the video perspective to observe behaviors according to the most relevant indicators. The involvement of the researcher in the community studied is essential to calibrate this observation and the recording to be produced (framing, timing, duration).

If the detailed characterization of behavior is necessary for the study of the activity, it is also necessary to approach its private, subjective side. In other words, understanding the activity implies understanding the actor's situation, which is significant for them *in situ* at the very moment they act. However, the meaning underlying the action is spontaneous, pre-reflected and largely implicit. The actor is not immediately able to make it explicit: "their descriptive thematization, and even before all this, their deliberate reflection, are neither spontaneous, nor immediate, nor direct, nor easy!" (Vermersch 1999, p. 13). Thus, if any actor is capable of reflexivity, they do not spontaneously adopt this position toward their own action. Verbalizations concerning the action are more often a discourse of rationalization and justification of the action than of elicitation. Consequently, different interview methodologies have been developed to assist the actor in making explicit what is significant for them at the time of their action (Rix-Lièvre 2010). Several of them use video to help the actor's re-immersion into their situation (Cahour and Licoppe 2010; Rix-Lièvre 2010; Theureau 2010). Indeed, a video trace of the activity presents different contextual elements that are conducive to specifying the moment in question and to placing the actor in the unfolding of their activity (Rix-Lièvre 2010). The video offers the actor the possibility of verbalizing what is significant for them as their activity progresses. It thus makes it possible, during the interview, to fight against generalizing remarks. Here again, the video construction methods must be indexed to the objective pursued. Video recording with an head-mounted video camera, when possible, greatly facilitates the targeted re-immersion (Omodei *et al.* 1998; Rix-Lièvre 2010). It prevents the actor from adopting a spectator position when confronted with a trace of their activity. Offering a physical perspective close to that of the actor *in situ*, the video is similar to a "*madeleine de Proust*"[3] that promotes elicitation.

Pursuing the objective of studying the activity of certain actors in extreme contexts and situations, video is mobilized during the field work to create traces of activity that can be mobilized *ex post* both for a detailed observation of behaviors and to encourage re-immersion in a moment in time. Depending on the focus of

3 http://www.americancommunityinfrance.com/lamadeleine-de-proust-proust%E2%80%99s-%C2%AB%C2%A0sponge-cake%C2%A0%C2%BB/.

research on the activity in an extreme context or extreme situation, the methodology will be different.

If the activity must be studied in an extreme situation, it is first of all a question of identifying with the actor the moments that the latter experiences as risky. To do this, the researcher must first avoid, through an epochal effort, projecting the extreme nature of a situation in order to help the actor make explicit what was actually significant to them at the time. Creating a record of activity at that time implies either a time-bound practice, for example the officiating of a high-level football match or a one-off intervention by an operator in an extreme context, or the actor's involvement in its production. In the first case, even if the researcher is not *a priori* able to define the extreme situations for the actor, they can create traces throughout the activity and then distinguish, throughout the interview, the extreme situations for the actor. In the second case, the temporality of the practice makes it impossible to produce continuous traces; thus, during a polar expedition, it is not possible to film all the preparation days, let alone the entire expedition in the field. Therefore, producing a record of activity when the situation is extreme for a particular team member requires either entrusting a recording device, in particular an head-mounted video camera, to the various actors concerned, or agreeing with them on a way to inform the researcher *in situ* when the situation becomes extreme in order to be able to produce a record. However, as we indicated in the previously, when the situation becomes extreme, it is first and foremost a matter of dealing with it, so few video traces are produced. This is a difficulty mainly concerning the observation procedure. Indeed, if the moment is experienced as extreme by the actor, it has a particular tone. The emotional valence of this moment is a springboard for the actor to return to their singular situation. As Vermersch (2004b, p. 28) points out: "Everything that has affected me and retained itself can be awakened again". Since the emotional valence of an extreme situation is a lever that favors the re-immersion of the actor in the moment under consideration, the interest of video to invest in the unobservable part of the activity is less. To study the activity of a person in extreme situations, video is essentially useful in order to accurately document their behavior.

On the other hand, when research is focused on understanding the ordinary activity of certain actors in extreme contexts, a video trace is a real asset in documenting both the observable aspects of the activity and its unobservable parts. Indeed, when an actor is confronted with this context on a daily basis, the activity deployed does not appear to them as a singular occurrence. The video specifies the moment studied and offers the actor, as well as the researcher, contextual elements that promote re-immersion into unfolding of their activity. In contexts where it is impossible to produce traces of continuous activity, the researcher's immersion allows them to identify operations, moments and stages that are potentially critical for the smooth running of the project. For example, during a polar ski expedition,

setting up camp, making water from snow/ice, orientation in a white and uniform environment are essential tasks for the smooth running of the project and the safety of the expedition members. These tasks are recurrent, performed once or several times a day throughout the expedition. The traces of activity produced by an head-mounted video camera, by another focused on behaviors, make it possible to identify behavioral regularities, but also encourage in interviews the re-immersion of the actor in a specified space and time. Thus, the video supports the actor's elicitation of what was significant for them at the time, without forgetting that the favorable conditions for this elicitation also depend on the role that the researcher builds in the group (Rix-Lièvre and Lièvre 2010; Lièvre and Rix-Lièvre 2013).

Whether to investigate the activity in an extreme context or in an extreme situation, to approach what is significant for the actor, to document the moments that affect them, to lead them to reveal themself, build a true relationship of trust and a charitable attitude toward the different practical rationalities. Thus, studying the activity of different actors in the same context requires capturing, without judging or prioritizing, the different situations and then contributing to an understanding of the convergences, divergences and controversies within the group regarding what is important and prevalent for each. The video then represents an anchoring point that ultimately makes it possible to compare, after having conducted the various interviews, each person's situation.

At a time when the appeal for *video-ethnography* is growing (Smets *et al.* 2014), positioning the uses of video in ethnographic work seems important to fight against the epistemological obstacles it tends to reinforce. This positioning is indexed first of all to the dimensions of organizing that are studied: the modalities of organization and regulation of collective action throughout the project, the activity of different actors at specified times and the specific norms on which they are based, the articulation of the activities of different actors, etc. The form, status and very function of videos in the scientific process are then different. In the study of the modalities of organization and regulation of collective action throughout the project, video makes it possible to construct a multimedia narrative that constitutes an intermediate production in the research process. In the study of activity, constructed videos are raw materials mobilized for a detailed observation of behaviors in specified contexts, but are also relevant as a re-immersion medium to invest in the unobservable dimensions of the activity. Finally, when it comes to ethnographing the *extreme*, the interest and nature of the videos are distinct when the focus is on extreme contexts or situations. In practice, we differentiate between traces of an activity actually carried out and traces of reflexivity *in situ*, the former being few in extreme situations. However, they are less necessary when it comes to using video as a re-immersion medium since emotional valence makes it easier. In addition, the absence of traces of activity is partly filled by traces of reflexive feedback *in situ* when it comes to understanding collective processes.

<table>
<tr><td rowspan="2">Investigating...</td><td colspan="2">Nature and function of the videos</td><td rowspan="2">Video status</td></tr>
<tr><td>...in an extreme context</td><td>...in an extreme situation</td></tr>
<tr><td>...actors' activity at particular times</td><td>Activity traces

To accurately document the observable aspects

As a re-immersion material</td><td>Activity traces

To accurately document the observable aspects</td><td>Materials

For the construction of materials</td></tr>
<tr><td rowspan="2">...the modalities of organization and regulation of collective action throughout the project</td><td>Activity traces</td><td>Traces of reflexivity</td><td rowspan="2">Materials

Intermediate production</td></tr>
<tr><td colspan="2">Multimedia narrative</td></tr>
</table>

Table 6.1. *Ethnography of the extreme: nature, functions and status of the videos produced*

Table 6.1 recalls the characterizations we proposed to specify the uses of videos produced during fieldwork when it comes to ethnographing the extreme. As the table shows, they are marked by scientific questions, but it should be remembered that their production depends on the researcher's participation and involvement in the community studied. The distinction between an extreme context and extreme situation leads to a differentiation of methodological mechanisms, but it remains to understand transitions. An important challenge is to understand the moments and processes of switching between context and extreme situations. Does an actor's situation become extreme at that moment or in a progressive way? Should we consider, in extreme contexts, continuums between a common situation and an extreme situation? How is everyone's activity and the modalities of collective organization being transformed? In order to shed light on these questions, ethnographic studies must be able to document in detail both the actual activity of the actors and the "organizing as it unfolds" in an extreme context *and* extreme situations and also between the *ordinary extreme* and the *extreme experience*.

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PART 2

Creativity and Organizational Reliability

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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SECTION 4

Organizational Creativity

7

Management of a Crisis Situation in a Large Video Game Studio

7.1. Introduction

This contribution aims to analyze how Ubisoft Montréal's studio was able to respond to a major crisis: the cancellation of the production of a blockbuster (a game with a sales potential of more than 5 million units) due to a lack of originality and strategic differentiation. Such a situation can be interpreted as a case of extreme management, insofar as a failure in this type of strategically important project could have threatened the company's financial health and viability.

Through the analysis of the *Always Playable* case (Cohendet and Simon 2016), this chapter aims to show how the producer in charge of the blockbuster and his team, with the support of the studio director, have contributed to reinvigorating creativity (to "unfreeze" the organization; Lewin 1951) by radically reshaping processes and recombining existing routines in-depth. Confronted with an unprecedented creativity crisis, this team has helped to radically redefine the way innovation processes are managed in a company. This transformation has a remarkable aspect: creative regeneration came "from within" by drawing on the existing routines, and by "breaking" and brutally reconfiguring routines that had until then been stabilized as "good practice" in projects for nearly 10 years. The regeneration of organizational creativity has not been achieved through smooth and continuous learning mechanisms: it has resulted in a profound questioning of existing rules, models and relationships, reinterpreting them and gradually proposing new rules, dynamics and standards in the management of innovation processes.

Chapter written by Patrick COHENDET and Laurent SIMON.

In this contribution, we show that this crisis management, which amounts to seeking a new balance between efficiency and creativity, has been made possible by recombining the ostensive and performative aspects of different routines. In the perspective of Pentland and Feldman's work (2003, 2005), the dynamics of routines are based on the generative tension between the ostensive (the abstract description of "what to do") and performative (the concrete actions taken in specific contexts) dimensions of routines. This "Copernican revolution" in routine theory (D'Adderio 2008) provides a theoretical framework for understanding the origin and formation of endogenous changes within an existing routine through the constant interaction between the ostensive and performative aspect of a routine. In the context of the crisis studied in Ubisoft's studio, the virtuous interaction between the ostensive and performative aspects of the main existing routines no longer produced the expected results. The endogenous creative dynamics were blocked. The producer and his team, noting these blockages, broke existing routines that no longer worked, and recomposed new routines by proposing new combinations of ostensive and performative aspects from different routines.

7.2. A creativity crisis at Ubisoft's studio

With more than 3,000 employees, Ubisoft's Montreal studio, inaugurated in 1997 by the French multinational group, is now the largest video game development studio in the world. The studio has successfully launched many blockbusters on consoles or other platforms (for example *Prince of Persia*, *Rainbow Six*, *Splinter Cell*, *Assassin's Creed* and *Far Cry*). It has also developed franchised games with a strong image impact among the general public, particularly in support of highly successful films (*King Kong* by Peter Jackson, *Avatar* by James Cameron, or *Tintin* by Steven Spielberg).

The studio's performance is largely due to its extensive knowledge of management approaches specific to the creative industries, particularly in the area of portfolio management of game creation and production projects. In terms of organization, the studio corresponds to the description of an "organization by projects" (Hobday 2000), with its portfolio of about 15–20 projects carried out at the same time. Projects are managed according to a classic *stage-gate* process that combines sequences of creation, design and production routines that are very well mastered and assimilated by the studio teams. The projects are independent of each other, and the "producer" or project manager acts as a true semiautonomous entrepreneur who works under a double control: that of the director of the Montreal studio and that of the creative management at the Paris head office (the editorial committee).

Stage-gate procedures work very effectively when the initial idea is clear, well expressed and already rich in references. On the other hand, in the case of a very new project based on emerging creative ideas, the *stage-gate* process can be particularly time-consuming as it involves extensive and lengthy discussions between the producer and the editorial board. This negotiated order can be frustrating when the project team tries to translate the creative line promoted by the editorial committee into technical constraints, or conversely, when the producer has difficulty getting the committee to accept his creative intentions or has to turn to his team to request changes required by the editorial committee.

In the case of *Always Playable*, after two successful experiences in the development of the first blockbuster episodes, for the next episode the producer was involved in the development of a new ambitious and potentially very innovative project compared to the firm's other products. However, from the very beginning of the *stage-gate*, he encountered the skepticism and reservations of the editorial committee, which called for clarification and modifications. This resulted in a very long back and forth between the team and the committee. These constant requests for changes, combined with the impression that the committee did not perceive the value of the new project's creative content, ended up completely discouraging the members of the creative team. In terms of routine, such a situation was potentially interpreted as a blockage between the ostensive and performative aspects of the *stage-gate* routines, which no longer fed each other. This led to a major crisis situation: the team's application (performative aspect) of established design and production standards (ostensive aspect), which had until then been effective, no longer produced the expected results and did not generate the creativity required to validate the continuation of the project.

After reflection, the producer, convinced of the impasse in which the project found itself and overwhelmed, on the one hand, by the dissonance with the editorial committee and, on the other hand, by the lack of motivation of the members of his team, decided to propose the termination of the project and to resign. To his amazement, the studio management refused his resignation and gave him carte blanche to experiment and redesign an effective and creative way to manage innovation-focused projects. Touched by this mark of trust, he accepted the challenge and embarked on an in-depth reflection with the members of his team on how to avoid such major creativity crises that were likely to jeopardize the very viability of the organization. Management gave him 3 months to propose an effective management method that facilitated more creativity by favoring a "bottom-up" approach based on the experience of the project members. The producer, who called this new project *Always Playable*, decided quite quickly on some major changes. Among the main changes were the following:

– the creation of the Foxteam;

– the implementation of the *fail faster* principle;

– the implementation of the *follow the fun* principle.

For the producer, by creating a dedicated team, the Foxteam, which had just experienced a creative failure, and the strong affirmation of its identity, it was a question of betting on a committed, shared, collaborative creativity and redefining processes that would support the expression of everyone's ideas and their combination in the product. For the team itself, this reflected the recognition that the informal group of Ubisoft members, passionate about finding creative solutions to escape the crisis, was recognized by the studio's top management as an official role to lead change. This recognition was symbolic: in the eyes of this small informal group, this "institutionalization" of their role was a strong way to legitimize their action with other employees of the organization and toward themselves.

The *fail faster* principle was inspired by a practice commonly adopted in some of the most iconic creative organizations (IDEO, IBM, W.L. Gore, etc.) inspired by hacker communities. Such a principle, which can also be found in the origin of "agile" project practices, promoted a culture of risk taking, but also of rapid learning through the sharing of experience. This principle implicitly expressed the possibility of generating ideas, validating (or invalidating them) by directly using the team's experience and judgment, where each member played a dual role of business and product expertise, based, in particular, on years of experience in use. It thus presented a major disruption in the traditional functioning of routines by giving the team the legitimacy to develop its own ideas without waiting for formal validation by an editorial committee or a hierarchical authority outside the project (a project office, for example). The *fail faster* principle suggests a new way of associating fundamental organizational values – the culture of ingenuity and creativity – with local validation principles that are more flexible than the sometimes costly and ineffective formal steps of the *stage-gate*, in the sequence "development by the team/validation by the authority (here the editorial board and management)". In the *Always Playable* approach, project group members had the legitimacy to validate their progress locally, "live" and without having to systematically wait for external validation.

The principle of *follow the fun* aimed to strongly reaffirm that the purpose of the collective effort is to ensure a shared direction and convergence of efforts in video game production in order to produce engagement in an entertainment activity. This principle thus imposed the commitment to entertainment, its quality and its maintenance, as the common reference points for collective action. This principle also recognized that the person who produced the game (most often a *gamer*) was well placed to evaluate by himself the "entertainment value" of a game (*fun value*). Such a principle also offered local teams the advantage of not falling into two fairly

frequent traps in the development of video games: on the one hand, the excess *technology trap* that consists of giving too much influence to technological innovation in a new game – the engineering prowess – and, on the other hand, the excess *aesthetic trap* – the art for art – which leads to focusing too much on the look and feel of a game. One of the concrete manifestations of the application of the *follow the fun* principle was the Foxteam's proposal to set up tournaments every Friday in the studio, where the team's employees play together, experience the game – even as prototypes – and share their impressions and criticism, which guide future developments. These tournaments were also quickly extended to a monthly activity where Ubisoft studio employees from other projects are invited to test game situations, and through their participation in these game events to help validate (e.g. through peer voting and formal feedback) the most attractive game situations that will actually be introduced into the game, but which could also be inspiring for other studio projects. There is general agreement that the success of the tournaments has helped to increase the creative potential of the entire organization, stressing that any design effort must focus, as one studio employee pointed out, on "the fun essence of the playing experience".

7.3. Management of a major crisis

In the following sections of this contribution, we try to show that the successive implementation of these major changes by the producer and his team correspond: (1) to "bisociation" phenomena in the sense of Koestler (1964) between two types of routines existing at Ubisoft, (2) to the formation of new routines obtained by reinterpreting and recombining components of existing routines that lead to new rules, new procedures and new practices that eventually spread and impose themselves within Ubisoft by contributing to a challenge to the management of innovation processes throughout the organization.

7.3.1. *Bisociation*

In his famous 1964 book, *The Act of Creation*, Koestler demonstrates that acts of creation have a common fundamental structure. He highlights that creation most often arises from the interaction between two separate "matrices of thought" that meet, what he calls a bisociation: "The privileged place of creative activity is always at the intersection of two planes" (authors' translation). According to the author, the essence of creativity lies in the "perception of a situation or idea through two frames of reference, each being coherent, but the two being mutually incompatible". To clarify this notion of reference framework, Koestler describes them as matrices of thought corresponding to "patterns of activity governed by a set of rules – its code" (authors' translation). A reference framework is characterized by a number of

routines, rules, codes, a form of logic and a "code of conduct" that determines the behaviors and expectations of individuals. Koestler gives the example of the frame of reference in which a spider weaves its web in a given environment from fixed rules "innate components" (fixed number of attachment points, center of gravity at the center of the web, strategic positions on the web to catch prey, etc.). A change of context – from the field to the corner of the wall of a house – will induce the spider to make the necessary adaptation, a source of creativity. Another example often mentioned in the book is Shakespeare's *Romeo and Juliet*: the Montague family's frame of reference respects the traditions of Verona, while that of the Capulet family respects the traditions and customs of Cremona, and the rivalry between the two houses is part and parcel of the conflict between Guelphs and Ghibellines throughout Lombardy (see Cohendet 2016). Within a given frame of reference, individuals are constrained by what Hatchuel *et al.* (2006) would today call "fixation effects" that limit their ability to innovate. The confrontation between these two clans and their respective traditions not only produces an unforgettable work of universal significance, but also paves the way to the possibility of another way of being beyond the positions of the two clans, which then announces the emergence of a broader political and social modernity that will affect all of Europe.

Bisociation thus characterizes the intersection (the "clash") between two generally incompatible reference frames. As Koestler (1964) writes:

> "I have coined the term 'bisociation' in order to make a distinction between the routine skills of thinking on a single 'plane', as it were, and the creative act, which […] always operates on more than one plane. The former can be called single-minded, the latter double-minded, transitory state of unstable equilibrium where the balance of both emotion and thought is disturbed".

We show below that to a very large extent, the implementation of new routines by the Foxteam to escape the crisis can be interpreted as a sequence of bisociation between "reference frameworks", in this case the existing routines of the organization, and the recombination of their components. The important point, however, is that from Koestler's perspective, creativity is not only about the intersection of two frames of reference. Once the "clash" has been achieved, it is a question of exploring the potentialities and gradually writing the new rules of the game of the new reference space obtained. The new rules, codes of conduct of the new reference framework, do not in any way correspond to a simple mixture of the rules and codes of the two initial reference frameworks. These rules, routines and codes must be constructed to fully develop the creative idea. For this reason, when two pre-existing frames of reference have been integrated into a new one, it may become difficult to imagine that they previously existed separately. The new framework rarely reveals all the imaginative effort it took to achieve it. "The

discoveries of yesterday are the truisms of tomorrow, because we can add to our knowledge but cannot subtract from it" (authors' translation). It is precisely in this perspective that the Foxteam's efforts were made to use the recombination of existing routines to design a new framework of practices, standards and codes for each of the new routines (*fail faster*, *follow the fun*, etc.) proposed to overcome the crisis.

7.3.2. *The recomposition of routines by a sequence of bisociations*

To interpret the way in which the Foxteam recomposed the existing routines within the studio to emerge from the crisis and revive creativity, it is worth recalling (Cohendet *et al.* 2014) that at some point several types of routines coexisted within the organization: first, corporate routines that reflected the main elements of the company's culture. These routines for Ubisoft's studio took the form of a way of being and behaving at work (brave and fair, relaxed and cool), dressing and communicating, but also of specific hiring practices ("in the studio, we mainly employ gamers, who are themselves regular consumers of video games"), and by encouraging the development of a true sense of community within the organization. Then, there were important technical routines, in particular through the standards and procedures imposed by the organization's technostructure to manage innovative projects (classic rules and practices of the *stage-gate*, for example, including validation standards by the hierarchy). Finally, different informal communities within the organization (such as the small group that made up the Foxteam) deployed routine communities, marked by the bottom-up experience of many of these informal groups, including critical appraisal practices for game quality.

In the perspective of Pentland and Feldman's work (2003, 2005), the dynamics of each of these routines were normally based on the generative tension between the ostensive (the abstract description of "what to do") and performative (the concrete actions taken in specific contexts, particularly by team members attached to each project) dimensions. A virtuous dynamic of interactions between performative and ostensive aspects is one of the foundations of an organization's performance, which ensures its functioning through the almost automated application of routines and the predictability of their results. However, in the case of the crisis studied here in Ubisoft's studio, the virtuous interaction – the predictable production of results – between the ostensive and performative aspects of the main existing routines no longer occurred. The endogenous creative dynamics were blocked. In particular, the ostensive aspects were strongly imposed by the technostructure to favor efficiency objectives. These aspects were reinforced by numerous artifacts (critical time diagrams, *stage-gate* charts, etc.) to guide and orient the organization's members toward this performance objective (d'Adderio, 2008). But at the same time, the passionate members of the group (which would become the Foxteam) developed many creative ideas through their day-to-day experiences, but also innovative

practices that could strongly contribute to the value of the blockbuster project to which they were committed. However, the technostructure remained immune to these signals, and did not integrate them into the project management, especially at validation times. The dynamics were blocked, hence the outbreak of this major crisis, which risked jeopardizing the viability of the organization.

The producer and his team, noting these blockages, and benefiting from the support of the studio management, broke existing routines that no longer worked and recomposed new routines by proposing new combinations of ostensive and performative aspects from different routines. Our interpretation is that this recomposition was done according to a sequence of bisociations between routines of different existing categories, in particular between corporate routines and community routines. The mechanism favored by the Foxteam was the borrowing of the ostensive aspects of corporate routines (highlighting the creative, informal, relaxed and participatory aspects of the studio) by combining these ostensive aspects with the performative aspects of community routines that were potentially active in the team members' ways of doing things, but which had been ignored by the technostructure until the crisis broke out (in particular here live validation by use, sharing and collectively experimenting with prototypes between team members and with external members).

The introduction of the Foxteam, inspired by the reference to the agility and skill of the fox (qualities that marry well with those of the studio), guaranteed that team members did not simply remain part of a temporary project team (which would then be dispersed at the end of any project), but, through the strong affirmation of an identity, keep a permanent structure that gives them the time and legitimacy to propose the major changes that they have been trusted with. Implicitly, the Foxteam procedure, which transforms a temporary project team into an active community, is based on ostentatious aspects that foster flexibility and skill (aspects found in corporate routines) with performative aspects of community-routines, such as learning through shared experimentation.

The implementation of the *fail faster* principle corresponds to the recombination between ostensive aspects of corporate routines (giving priority to creativity) and performative aspects of community routines, where the practices of knowing how to bounce back from failures are considered to be at the heart of creativity (fail in order to learn, make to learn, whereas these same practices were categorically rejected by the technostructure that considered them to act against the objective of effectiveness, from a play to win perspective). The same applies to the principle of *follow the fun*, which can be interpreted as resulting from a bisociation between ostensive aspects of corporate routines (highlighting the play aspect in many statements of the organization's culture) with performative aspects of community routines, where it is

necessary to constantly play even with unfinished aspects of the game to capture the fun and adjust the work, and considering that these practices are essential to ensure the creativity of a game.

Once the different sequences of bisociation had been carried out, as in the perspective identified by Koestler, very great attention was paid by the Foxteam (and by the studio management) to redefine new codes, new practices and new standards within the new routines put in place. These new routines largely replaced the previous ones supported by the technostructure. This substitution reflected a change in power relations within the organization, with greater freedom for grassroot creative initiatives than for the effectiveness directions provided by the technostructure. The latter accepted the proposed changes relatively well, since after the crisis, a feeling of "shared guilt" animated the entire organization, and validation by the expertise of use – the experience of the expert developer-player – and its extension to almost all the studio's employees had shown its effectiveness in time and quality.

7.4. Conclusion

In conclusion, this contribution sought to show how, in the face of a major crisis, an organization can draw on its existing routines to find a response to such a situation that could jeopardize the very viability of the organization. The response to the creativity crisis and in particular to the incompatibility between efficiency and creativity has been obtained by recomposing routines through bisactional sequences that modify the generative relationship between the ostensive and performative aspects of existing routines. This major creative crisis that triggered a profound organizational change has allowed the organization as a whole to learn new practices, increase its creative potential and become more resilient and responsive to new crisis situations and expanded creative needs.

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8

Organizing Innovative Design or How to Remain an Explorer: The Case of Creaholic

8.1. Introduction

We find ourselves here in "extreme innovation". The typologies of innovation today articulate "disruption" and have highlighted in the literature for decades radicality, discontinuity, disruption, etc. This chapter will deal with the manufacture of disruptive innovations. More precisely, it will focus on a particular form of organization that allows it to maintain itself sustainably in "extreme innovation".

The organization is not at odds with innovation as it has designed a device adapted to the particularities of the innovative design processes. How does innovative design activity work? How is it organized? This chapter focuses on the particular case of professional designers, companies that have specialized their activity in the manufacture of repeated disruptive innovation for customers. These B2B companies, not very visible to the general public, explore and innovate for others. Seen from the customers' point of view, this type of company is a service provider that offers innovative concepts, but also and above all, innovative deliverables that can integrate complex technologies. Behind the false image of Épinal as cool, young and relaxed innovators, these companies – which we will call innovative design enterprises (IDEs) – are true professional inventors who rigorously combine creativity, knowledge, agility, speed and efficiency in various fields of innovation. Today, as the term innovation is so overused and widespread, it is important to highlight the specific nature of these enterprises. They do not only

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work on ideas or concepts, they also realize and deliver an innovative *output.* They concretely produce innovation. More generally, these IDEs testify to an ease in managing that unknown part of the shadow that scares existing enterprises so much. Historically, Thomas Edison had, at the turn of the 20th Century, built a formidable organization of varied, systematic and repeated innovation in Menlo Park and West Orange, NY, USA. Edison's innovation factory was working simultaneously, and in incredibly different fields, on the development of new technologies, the development of new distribution modes (e.g. licensed vendor systems), the design of new industrial systems (e.g. the development and industrialization of complete sound recording systems up to and including its paid broadcast) and the design of new customer values (e.g. exploring new mass entertainment markets around sound and image).

How do these disruptive innovation manufacturers work? How are these professional designers organized? This chapter involves an in-depth case study covering eight years of continuous interaction with a Swiss innovative design company. Creaholic is an integrated development environment (IDE), a creative laboratory specialized in the design of new identities and in the design and development of new products/services, new technologies and their industrialization. The company was founded in 1986 by Elmar Mock, co-inventor of the Swatch, just after he had left the holding company that bears the same name as the famous watch it manufactures. The IDE studied is positioned on exploration, which will lead to questioning the results from the literature on ambidextrous organizations. What are the *governance structures and organizational principles of an enterprise focused solely on exploration and how is the combination of exploration, and exploitation achieved under these conditions?* The first part briefly reviews the literature that structures innovative design and ambidextrous organizational forms. The second will focus on Creaholic's governance and organization, while the third outlines a concluding discussion on exploration/ exploitation "looping" between the IDE and its clients.

8.2. Innovative design and ambidextry

We will use the term innovative design to characterize innovation processes that aim to revise the known identity of objects (Hatchuel and Weil 2002, 2003, 2009). This criterion has been retained as a demarcation line between regulated design processes and innovative design processes (Le Masson *et al.* 2010). The regulated design is based on management processes to renew the stable identity of known objects. Under these conditions, management is teleological, i.e. it can start upstream of the process by defining the target to be reached at the end of the process (notion of "specifications" in project management, for example). Managerial management is carried out by reducing the differences observed. Here, the value is

identified and the trades involved in the design process are known. Innovative design, on the other hand, aims to generate objects with new identities, unknown at the beginning of the process. Because the disruption of identity of objects is the object of this design, the management that this exploration implies is profoundly different from that of regulated design. It is the organizational dimension of innovative design management that is important to us here. The work of the *École des mines de Paris* on innovative design has historically been based on the dual register of *cognitive* (with C-K design theory) and *organizational* with the research/innovation/development (RID) model. RID is opposed to and articulates the research and development (R&D) model, which is the previous and fundamental model of regulated design. The R&D model works well when the object identity model is stable. We will not repeat the RID model here, but will extract a central idea from it, which is the organization for itself, in its particularity, of the innovation activity. Research, which is a knowledge-producing activity, can only generate genuine disruption innovations and can only work on a subject if "we" (the "I" function or "innovation" precisely) "prepare the ground" for it. A research laboratory cannot generate a conceptual disruption, but it will, for example, be able to identify or develop the technologies necessary for an innovation. We will discuss this innovation function in light of the literature on ambidexterity. This literature has the advantage of making it possible to situate exploration or innovation activity in relation to operating activity. This will provide us with a framework to characterize Creaholic's design activity in relation to that of its operating customers.

8.2.1. *Forms of ambidexterity*

The sciences of organizations have long since integrated the ambivalence of reasoning together antagonistic logics on integration and differentiation. Burns and Stalker (1966) had described in their time the types of organic organizations (as opposed to "mechanics") adapted to changing and innovative environments. The current work on ambidexterity is based on an organizational approach to a dilemma formulated by March (1991). March's text deals with organizational learning. It analyzes the different ways of seeking solutions to the problems encountered in organizations and opposes two approaches: exploration and exploitation. "The essence of exploitation is the development and extension of existing skills, technologies and paradigms. These effects are positive, rapid and predictable. The essence of exploration is the experimentation with new alternatives. These effects are uncertain, long-term and often negative" (March 1991, translation of French quote). As for exploration, "includes things (sic) understood in terms such as research, variation, risk-taking, experimentation, play, flexibility, discovery, innovation". Exploration activities require a high degree of organizational adaptability. Operations, on the other hand, rely on a stable organization that guarantees the recurring execution of operations. Learning in operations provides

almost certain short-term gains, although they remain small. This is why it is favored by organizations. However, there is a risk that the organization will become more rigid by continuing to use and improve "outdated" technologies, when new technologies or different approaches would lead to better performance. Consequently, a systematization of learning by exploitation limits the company's ability to adapt in the event of changes in the environment (Charue-Duboc 2005). The challenge is also to maintain exploration processes in the organization. March believes that it is necessary to balance the resources devoted to each type of learning and ensure that they alternate over time.

Ambidexterity refers to the way in which an organization articulates operational and innovation activities. In this management of ambivalence, the perspective is twofold: to take advantage of differences (of one to help the other) and to prevent disruption (of the other by the other). Peter Drucker (1974) was one of the first to insist on the impossibility for the same organization to manage what already exists and to generate novelty. The notion of an ambidextrous organization was first used by Duncan (1976) who saw the need to adopt a dual structure according to the stage of development at which the innovation is located. Since March, management authors have advocated a "specialization in" (one could also say a "differentiation between") exploration and exploitation activities (Garel and Rosier 2009). An ambidextrous organization appears to be an organization that reconciles two contradictory imperatives with a different time horizon: short-term adequacy and long-term adaptation (Gibson and Birkinshaw 2004; O'Reilly and Tushman 2004). By separating exploration or innovative design activity from the rest of the company's current activities, companies are prepared against the risk of being locked in and systematically retreating into key competencies (Leonard-Barton 1992).

Three ambidextrous forms of organization are described in the literature:

– *structural* ambidexterity is in line with Duncan's work, where exploration and exploitation activities are distributed among different and specialized organizations within the same company. Benner and Tushman (2003) see "structural" ambidexterity as the separation of these two activities into independent units but linked by top management. For Tushman and O'Reilly (1996), the ambidextrous organization has the ability to be both competitive in mature markets (where notions of incremental cost, efficiency and innovation are critical) and innovative in terms of product development for emerging markets (where experimentation and innovation are key);

– *contextual* ambidexterity, where exploitation and exploration activities are assigned to different projects within the same organization that then manage different projects, more or less exploratory, in the more or less long term (Ghoshal and Bartlett 1994). Here, the approach is temporal, with the organization going

through phases more oriented toward exploitation or exploration. Boumgarden *et al.* (2012) propose the term "vacillation" to characterize the organization's comings and goings between the two phases;

– the ambidextrous *network* that separates exploitation and exploration activities in legally different entities, under different, complementary and articulated organizations. This is co-design. Creaholic and its corporate clients are part of the ambidextrous network.

8.2.2. *Ambidextrous relationships*

How can we establish or maintain the exploration/exploitation connection? Exploitation is not an end in itself. It is in its ability to become an exploitation that this activity is organized. How can we move from exploration/exploitation "coexistence" to "switching" from exploration to exploitation? In the case of an internal structural ambidextrous structure, O'Reilly and Tushman (2004) and Benner and Tushman (2003) assign a key role to senior management, which promotes and communicates shared values and visions, and sets or authorizes projects by allocating resources. Contextual ambidexterity reinforces the scope of this argument since it does not separate entities. Taylor and Helfat (2009) and Ben Mahmoud-Jouini *et al.* (2007) have shown that leaders are not the only ones who play an interface role between the two logics, but that operational teams are required to interact. Gassmann *et al.* (2012) have identified five ways of transitioning between exploratory activities and their integration into the company's existing activities:

– external validation, where the exploratory entity will mobilize clients to set up pilot projects in order to enroll the rest of the organization;

– the return of exploratory team members to their original unit to act as spokespersons;

– the manufacture of prototypes as demonstrators;

– "innovation villages" where the exploratory entities present all their achievements to the entire organization;

– the sharing of product and technological roadmaps.

Ultimately, the exploration entity may transfer the exploration result to entities existing within the organization (structural ambidexterity) or outside the organization (network ambidexterity). It is also possible that the exploratory entity leads to the creation of a new entity, responsible for developing the innovative output from the exploratory phase. Ben Mahmoud-Jouini *et al.* (2007) distinguish four typical situations, depending on whether the exploratory structure is permanent or temporary, and whether the result of the exploration activity is transferred to

existing entities or leads to the creation of a new entity. In the automotive industry, advanced engineering units have been developed, linking exploratory activities and product development (Midler *et al.* 2012). Modular innovation strategies around vehicle platforms play an essential role here.

8.3. The case of Creaholic, an innovative design company

We will first describe the Creaholic company and our methodological relationship with it, then we will focus on presenting the governance structure by which the company forces its continuation in exploration.

8.3.1. *Creaholic, an IDE that produces repeated innovation*

Creaholic works on its own projects or those of its clients. An innovation service to external customers, whether multinationals or SMEs, represents 80% of the activity of this IDE. Since its creation in 1986, it has developed more than 750 innovations, filed 180 different patent families and created eight start-ups. The enterprise has about 60 main customers. Its customers are 60% multinationals such as Air Liquide, BMW, Bosch, Nestlé, Swisscom or Tetra Pak. The enterprise also works with small and medium-sized entreprises (SMEs), most of them located in Europe. Creaholic is active in various sectors, including the automotive, mechanical, medical, life sciences, watchmaking and food industries. Many projects have been carried out, such as new hearing aids, intelligent pet collars, measurement systems for people with epilepsy, an electromechanical kit that transforms the Fiat 500 into a hybrid car, a device to measure the level of oxygen remaining in a scuba tank or a snowboard binding that adapts to multiple shoe sizes, etc. The enterprise employs about 30 people, from different origins and cultures, and is forged with unique specializations. In over 30 years of development, less than 10 employees have left the company, which has grown gradually and done so by organic growth. It is composed of various creative experts in physics, in materials (plastics, wood in particular), electronics, chemistry, mathematics, law or intellectual property, interior design, design, economics and business development. Creaholic works from design to pre-production, including esthetic study, engineering, construction, patent research and filing, prototyping, analysis, and the use of appropriate materials and shapes. Creaholic ignores the boundaries between disciplines, services and sectors, working across the board on new and even unknown topics.

Of course, the IDE status does not formally exist, while a crowd of companies are surfing the trend of contributing to innovation for their customers. It is particularly on this criterion, but not only, that the status of a company like Creaholic can be defined. Creaholic is not a fashionable company, but a company

that has structured its governance and organization in a sustainable way to move through the modes of innovation. This argument alone serves to distinguish Creaholic from a company like Ideo (itself famous, particularly in the media), which has established itself and has built on the design thinking method. Basically, the vocabulary used by consulting firms in innovation, advanced engineering, innovative design and creativity is extremely varied and generates a certain amount of confusion that should not prevent us from clarifying the contribution of IDEs. To do this, we suggest two tension pairs (see Figure 8.1). We could also have retained the opposition between specialized companies (for example in a sector such as airport IT) and generalist companies.

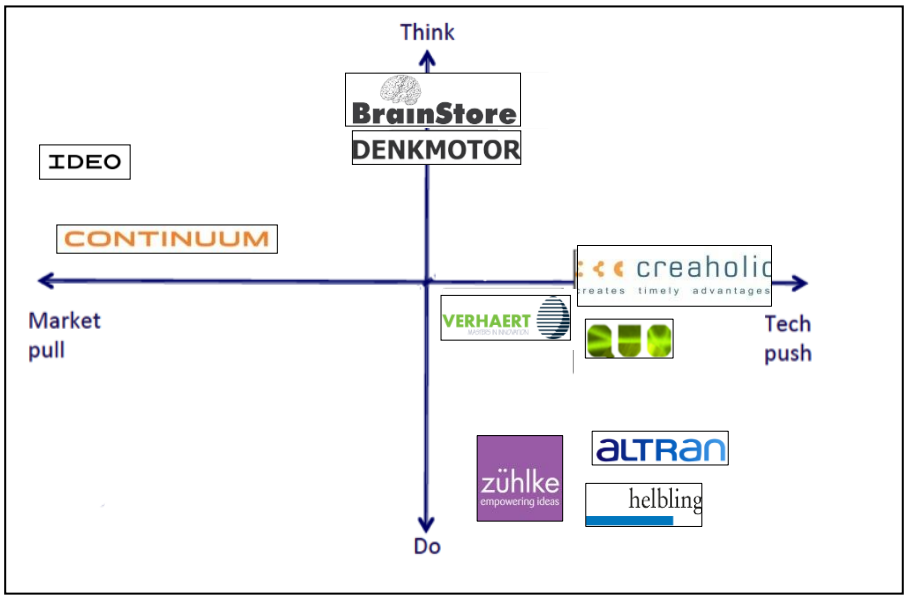

Figure 8.1. *Typology of companies with innovative design (Engelmann 2015)*

Finally, Creaholic is an IDE capable, over the long term, of working on groundbreaking concepts, but also and above all, of reaching operational deliverables (which can integrate a complex technological or scientific dimension) that are surprising and effective for customers, and the end market in a wide variety of fields.

As Yin (2003, p. 13) notes, the case study is a tool for exploring phenomena in their context. We are immersed in the Creaholic context in various ways. The work is based on a study that began in late 2008 and continues to this day. In 2008, the relationship was first and foremost pedagogical, because for us it was a matter of teaching with Swiss students in the Creaholic company for half a day. It was an

opportunity for a theoretical presentation of C-K and a strong debate on its "usefulness" for the company. Curious, Elmar Mock later asked us to continue the exchanges on innovative design. This was the beginning of an interpersonal relationship that would then become friendly and lead to the publication of a book (Garel and Mock 2012, 2016).

The bonds of friendship that are gradually being built between the reflexive practitioner and the field researcher must lead the latter to set up mechanisms guaranteeing the objectivity and distance necessary for the analysis of their object. This research work is based on the analysis of the company's working documents and archival documents, systematic interviews with Creaholic partners (mobilized as reviewers of publications) and some of the employees, participant observation of the innovative design activity, regular visits to the company, and monitoring of its current status in the business press. We participated in research on Creaholic with a collective of researchers in 2009 (Pichault and Picq 2013). A multidisciplinary team of four complementary researchers (innovation, human resources, organization and psychology) analyzed the company's internal organization principles, and innovation model through interviews and documentation. The researchers exchanged their results in order to build a shared global understanding, informed by the specialized thematic analyses provided by each. A restitution was then made, several weeks later, first to the manager and then to all employees. We also mobilized the enterprise as part of a film shoot in Switzerland in the Mooc "innovation et société" in 2015. It was an opportunity to co-construct a discourse on the organization of innovative design, particularly on the spatial dimension of the IDE and its governance. Over time, the continuous work and longitudinal sections enabled the author to build up a substantial empirical database of data on Creaholic, validated by the actors in the field. In other studies, the C-K theory framework has been used to reconstruct Creaholic's exploration processes. The highly confidential nature of the innovation projects Creaholic works on for its clients totally prevents us from discussing the details of the B-to-B innovation factory.

8.3.2. *A relevant governance structure*

In management, the mode of governance refers to (1) all the rules of exercise and control that govern power in and of the enterprise and the ownership structures of enterprises (family, controlled, managerial) and (2) the analysis of macroregulations (market, hierarchy or network). We will use the concept of governance structure here to focus on describing decision-making processes, ownership and incentive structure, and the exercise of authority. A governance structure, apparently simple but complex to implement, has enabled Creaholic to maintain its consistency and IDE objectives for 30 years. Governance is based first of all on five elementary principles:

– not to produce or sell on the market the result of its designs. If the company did, it would then be in need of organizing its activities in exploitation rather than exploration: produce, distribute, improve. It is in this case that past developments structure the organization and not innovative design;

– not to collaborate with its customers' competitors, because disruptive innovation means knowing, or even determining, the future of its customers. Mutual trust is therefore an essential condition. Compliance with this principle requires Creaholic to constantly seek new territories for products, services, concepts and knowledge, in which the company is not *a priori* recognized as a specialist. That is precisely how it will be in a better position to support new proposals. This is a principle that constrains the expansion of the knowledge base;

– as a consequence of this expansion of exploration spaces, the formation of the team must therefore be extremely multidisciplinary, while avoiding the trap of specialization that generates crystallization. The need for growth and permanent instability, due to the absence of repetitive or long-term projects (there is no work schedule beyond 3–6 months), force Creaholic's team to find new areas of activity. "We are always on the road," explains one of the company's managers. This forced change constantly leads to the discovery of new areas of knowledge. It is not the best use of acquired knowledge that is the company's objective, but the expansion of knowledge. "We are often confused with engineering or design offices, when our action stops where it begins", says E. Mock. Creaholic extends its knowledge where a design office makes rational use of the knowledge it possesses;

– a traditional structure of hierarchy (in the sense of the formal exercise of authority in the organization) and capital is counterproductive in innovative design. Creaholic sought a mode of governance compatible with creative profiles, even encouraging creativity – particularly on the need for recognition and sensitivity to injustice. The leaders of Creaholic have designed their own organizational system in the form of an oxymoron, that of the capitalist kolkhoz. It is characterized by total transparency within the company, on sensitive aspects such as individual income, bonuses, overall accounting and the state of the order book. Another major difference in governance is that the shareholding is non-transferable and therefore necessarily linked to the activity within Creaholic. In the following, we get details of this original provision, with significant behavioral consequences. In addition, all important decisions are taken by a majority of the shareholders present, regardless of the capital shares held. The decision-making process is deliberative, with everyone expressing, exposing and defending their point of view. This governance is not intended to be egalitarian, but motivating and equitable. Its implementation was encouraged by the desire to best fulfill the company's mission, which thus remains able to adapt to the instability of its activities;

– as Creaholic refrains from direct marketing, in the second half of the 1990s, the company's managers decided to develop in parallel with the activity of designer

at the service of its customers, an incubator transforming some of its own ideas as a start-up. While Creaholic works mainly for external customers, the company also generates its own innovations. It is then necessary to confront the realities of financing and "take" the idea to the market. This secondary mission absorbs 20% of activity time. It allows new knowledge to be acquired in the main activity, but also defines and tests business models. Creaholic's start-ups strengthen its credibility in the core business and differentiate the company from other "innovation consulting" companies. Finally, it is a means of communication on the innovation factory ("we do for us what we promise you"). Creaholic has sister companies such as Miniswys SA, which develops miniature actuators based on piezoelectric technologies, WoodWelding SA, on ultrasonic welding of wood and bone, Smixin SA, on ultra-economical water distribution (90%) for hand washing, and Joulia SA, on green energy, which manufactures showers with heat recovery units. Creaholic is expanding a new company about every 2 years. Creaholic has developed an "out-of-domain rights" strategy with customers who accept it. Creaholic then recovers the exploitation rights on the outputs resulting from the innovation developed for the customer and patented but in another field of activity, without competitive recovery. For example, with a customer in the automotive sector, the possibility of reusing concepts and knowledge in an area of innovation outside the automotive sector will be negotiated. It is not only an innovative processor design for its customers, but also a firm that innovates for itself. The employees who are at the origin of the start-up, if they want to take it to exploitation level, are forced to leave Creaholic. Beyond these principles, how does such an organization work?

8.3.2.1. *The partners*

Anyone working at Creaholic is a "partner", thus erasing the purely wage relationship from the vocabulary. Partners are consulted on important company decisions and have access to all the company's strategic information in an "open book" format. A partner is also an investor in a spin-off start-up project. These participations are then part of the partners' assets, not Creaholic's assets. Any partner can become a shareholder in the long term and according to "merit". Just over one-third of the partners are shareholders.

8.3.2.2. *The shareholders*

Only a person who works at Creaholic and has allowed it to develop can be a shareholder. The capital is in the hands of the shareholder partners only. It is closed to external contributions, which is not the case for Creaholic start-ups, which may be open to investors. Capital cannot be inherited, shared or sold to non-partners. It follows that the shareholding is a strict reflection of Creaholic's history and development. The enterprise has linked activity and ownership to avoid any annuitant capitalist behavior that, focused on ownership alone, survives on the return

on its assets alone. The enterprise is valued at its minimum, at about one-third of annual turnover. The purchase and sale price of the shares is set at the lowest possible level, voluntarily limiting the company's assets. The enrichment will not come from capital, but from innovative activity! Because only active members of Creaholic can be shareholders, because external investors cannot be shareholders, because the value of the shares is low and because Creaholic refuses to work with its customers' competitors. Only business development creates value, with no annuity, no renovation and no repetition. There is no other way than innovation under these conditions. The distribution of capital is not egalitarian since one-third of the shareholders must hold more than two-thirds of the shares to ensure the presence of an experienced core (five shareholders hold 90% of the capital). However, shareholders decide on the egalitarian basis already underlined by "one person, one vote" on all strategic decisions: contracts, bonuses, salary increases, start-up launches, capital increases, hiring, strategy, investment, partnerships, etc. A shareholder, like a partner, is also an investor when they decide to allocate resources to a spin-off project. The employees concerned are allowed to keep these shares even if they leave the company. This scheme compensates for the loss of dividends resulting from Creaholic investing the money in its start-up companies, instead of distributing it to its partners (always the idea of paying oneself on the activity rather than on the annuity). Shareholders' profits are realized through dividends and spin-offs, and not through the result of the sale of shares. Any departure of a shareholder implies the sale of its Creaholic shares to the remaining shareholders. The entry of a new shareholder into the capital depends on the "merit" recognized by the existing shareholders. In 2015, the company had three main shareholders: Elmar Mock (30%), its first partner, Marcel Aeschlimann (30%) and, a third partner, André Klopfenstein (20%). These percentages will change as the company prepares to pass the torch to a new generation.

8.3.2.3. *Remunerations*

Fixed salaries are below market, lower than what the skills of Creaholic employees would allow them to find in other companies. In times of crisis or underactivity, the lower level of the base salary has allowed Creaholic to maintain jobs. A variable part may be allocated each year. Annual profit sharing is divided: one-third to partners and two-thirds to shareholders. Innovation keyplayers can also be distinguished each year. This distinction is the result of collective debates and a fine recognition of individual contributions, identified by the time spent on each project. In terms of management control, the monitoring of hours worked is very precise: the company knows in real time the turnover generated by each partner. All these data are accessible to everyone on the computer system. It is indeed the community of shareholders, who share the majority rule, that decides to allocate the result.

8.3.2.4. *The organization of the workspace*

> "The building that houses Creaholic (an old soap factory) reflects the organization: very open and unconventional, designed to stimulate informal discussions. It allows project teams to position themselves with the tools they need according to the evolution of the project." (Pichault and Picq 2013).

The enterprise is not structured into departments but is presented as a vast open space that in practice distinguishes three different areas of activity:

– cells or platforms where teams working on a project work;

– spaces for collaboration or exchange free from direct involvement in projects. These spaces are of two types: on the one hand, conference rooms and, on the other hand, more informal spaces, such as a relaxation area and a coffee bar; employees often have lunch together and, once a week, each in turn (including the most "capped" partners), an employee organizes for all the best possible lunch at a minimal cost;

– experimentation, testing and rapid learning areas similar to test laboratories with machines such as 3D printers, laser cutting, metalworking machines, injection molding machines and carpentry. Here, we find the strong principle in the innovation factory of frequent and rapid experimentation from the short and low-cost transition from a concept to what is tangible (Thomke 2001). There is no technical staff assigned to these spaces: it is the partners/shareholders who use them. This is the response of the classic absence of hierarchy (on the one hand, the leaders, and, on the other hand, the "those who do") and the need to totally and concretely intertwine the manual and the intellectual. There is free movement between the different areas, very close to each other. It is on this condition that an enterprise becomes agile, in the sense that it facilitates movement and speed, both intellectual and manual.

This section has described the governance structure and organizational principles of an enterprise that is forced by these choices to remain in exploration mode. Creaholic refuses to settle in a situation of unearned income and maintains itself in a form of assumed imbalance and fragility, on the "brink of chaos" (Brown and Eisenhardt 1998). How is the combination of exploration and exploitation carried out under these conditions?

8.4. Discussion and conclusion: the IDE and a return to exploitation

The literature on ambidexterity is not lacking in arguments to analyze the relationship between exploration and exploitation, as outlined in Part 1.

> "An organization that engages exclusively in exploration will ordinarily suffer from the fact that it never gains the returns on its knowledge. An organisation that engages exclusively in exploitation will ordinarily suffer from obsolescence". (Levinthal and March 1993, p. 105)

The literature also shows that an organization capable of carrying out exploration and exploitation activities offers better results than an organization that focuses only on one or the other activity (He and Wong 2004). Here, we are faced with a counterintuitive choice to focus on exploration. IDEs specialize in exploration and ensure that they do not "switch" to exploitation to preserve their capacity for innovation in the long term. In practice, the link with operations exists and is established in an ambidextrous network between the IDEs and their clients. Here, we will outline the relationship between the IDE and the client company.

For a firm that both exploits and explores and freely questions its innovative design strategy, it can manufacture the innovation itself (structural ambidexterity), it can acquire entities that have already innovated (start-ups for example) or can work with the IDE. The latter strategy consists of outsourcing innovative design using an external innovation service provider. The relationship that is established between the IDE and its customers is a true co-design in reality.

A famous German car manufacturer and a very large German steel group asked Creaholic for a paradoxically designed brief: "We want to innovate in the design of vehicle steering columns to reconcile the extreme rigidity of the column in driving use with its softening in the event of an impact in order to protect the passenger compartment; in other words, we want a column that is perfectly rigid when driving but soft in the event of an impact". What deforms without deforming? What are the physical properties of a deformation without deformation? What are the starting analogies of innovative design reasoning? The penis or can does not seem to be a very serious subject to deal with large industrial customers. Yet it is on these paths that Creaholic took them! A can is rigid when it is full and flexible when it is empty. Can we design a steering column containing a liquid that releases in 5 ms in the event of an impact and then allows the column to deform instantly? We are no longer working only on the ownership of the steels (which is the strong point, but focusing, of the steelmaker) but on the redefinition of a steering column. Before the design stage, Creaholic's teams organized "trips" with the client to deconstruct and rebuild with them along the way, making the initial question, without hesitation, to rush them, to bypass their representations and defenses. Client involvement is a condition for the future acceptance of innovation within the company.

Box 8.1. *Early and continuous involvement of the future customer operator in the IDE's innovative design (Garel and Mock 2016, p. 135)*

Clients entrust the IDE with a disruption mandate based on a very conceptual and exploratory brief or an innovative technological challenge. Each time the mandate or innovation subject is redefined, discussed, adjusted, amended, co-designed with the client. The literature on start-up integration difficulties highlights the risks of too strong a separation between start-ups and companies (Burgers *et al.* 2009) and one of the causes of start-up mortality is based on an exploration too far removed from the capacities and routines of the operating company (Hill and Birkinshaw 2014). Because the client operator is integrated from the outset into the design, the probability of acceptance of an exploratory output is higher at the end. There is less "cultural surprise" because the client is involved in all stages of design.

Ultimately, the success of innovation, if so, belongs to the client. It is the brand of the client company that assumes the success of the innovation and disseminates it. This implies an erasure, a humility, sometimes difficult to assume in creative people who want to mark with their name the invention and the innovation that follows. Exploitation is more visible than exploration. Creaholic inside is a discreet and effective value for B2B customers but not a brand for the end customer. It can be seen here that, internally, the system of recognizing IDE partners or collaborators must be all the stronger as there will be no external recognition from the client or the market. The IDE management system described in the Creaholic case in the previous section incorporates the discretion and eradication inherent in the nature of its activity. Only clients and partners who have shares in Creaholic's start-up companies (but leave the IDE because you cannot be an operator and explorer) "take the light" of the success of the operation. Nevertheless, Mock's very strong personality takes the light of exploration with the risk of generating tensions among collaborators and partners (Pichault and Picq 2013). In fact, each time we look at concrete mechanisms that structure exploration activity or the relationship between exploitation and exploration, the problem shifts toward the dynamics of human resources:

> "Not only do Creaholic's executives not pursue size, but they do not favor a particular future for the company. They want to maintain conditions that, in the present, make it possible to envisage that the modes of action will be preserved in the future. It is then the (exploration) projects themselves that make the company what it is all about." (Asquin 2002)

In practice, human resources management policies must be studied in detail to measure the pressures borne by individuals engaged and maintained in exploration (Pichault and Picq 2013). This is one of the conditions for the existence and success of the IDE.

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SECTION 5

Creativity under Constraint

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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9

Creativity under Constraint: A Management Sciences Perspective

9.1. Introduction

Creativity as a process of generating and selecting new, useful and achievable ideas is paradoxical in nature. On the one hand, the creative process should be unstructured, open and unconstrained ample resources, with time and space for ideas to emerge and mature (Amabile 1996; Shalley *et al.* 2004). To self-express, people's creativity would require a setting protected from outside influences, comfortable and in a fascinating environment, long incubation periods, a recurrent rhythm of activities, access to quality and abundant information and many connections with colleagues in various disciplines (Csikszentmihalyi 2006). On the other hand, creative practitioners develop structured methods to channel creativity into a constrained space and time period (Osborn 1953). For many researchers, the creativity of individuals and teams is enhanced by resource, time and procedural constraints (Baer and Oldham 2006; Ohly and Fritz 2010). Similarly, to solve problems that integrate many constraints, creators and inventors must break out of existing conceptual frameworks and make new associations that create disruptions on the principle of bissociation (Koestler 1964). There is, therefore, an underlying paradox in creativity between freedom and constraint, two elements that seem essential to promoting individuals' creativity. However, the current economic and technological environment, driven by rapid change and profound disruptions due to globalization and the digitization of activities, is pushing organizations to change more and more quickly. The idea thus becomes a resource, as strategic as information and knowledge, to achieve these constant changes, and organizations are increasingly interested in how to generate its emergence to nurture the capacity to renew its products and services and the organization itself. For example, the BNP

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(Banque Nationale de Paris) insurance division includes a small team entirely dedicated to the management of creativity. At group level, nearly 30 people (not even 50 people) attended the CREA conference in Sestri in 2016[1]. Just like innovation, creativity is therefore gradually becoming a strategic concern for companies. Nevertheless, organizations are small "societies" under strong constraints, with multiple procedures, tight budgets and time management that is often millimeters long. Amabile and colleagues (2002) noted that time pressure was increasingly felt as a problem by American employees. The situation in the corporate world has not improved since then: managers are generally overloaded with files to manage and jump from one subject to another. Examining and understanding this paradox therefore becomes crucial to "managing" creativity in organizations. In a study of creativity conducted in three companies in the creative industries, Andriopoulos identifies six paradoxes that organizations must "tackle" in order to manage the creativity of their teams: providing exciting projects to employees while achieving financial goals, giving them difficult tasks while maintaining their confidence in their abilities, encouraging personal initiative while maintaining a shared vision, encouraging diversity while building a strong team, learning from the past while seeking new areas of knowledge and taking incremental risks while opening up new avenues for disruptions (Andriopoulos 2003). These types of paradoxes do not only affect the management of creativity in the creative industries, whose core business is the management of ideas, but also in heavy industry. A study conducted at Hydro-Québec, a power generation and distribution company, identifies four challenges for managing team creativity: taking the time to explore while performing daily tasks, sharing and collaborating while meeting individual assessment criteria, respecting strategic priorities while having sufficient flexibility to experiment and generating many ideas while developing only a few (Harvey *et al.* 2013). These paradoxes highlight the multiple "double constraints" on the nature of the creative task, problem solving, individuals and teams, and management styles in creative processes. In this chapter, I propose to examine more precisely the nature of constraints and their effect on creativity from an organizational perspective in order to explore possible solutions in order to overcome the paradox of creativity under constraints. In this chapter, we present the different types of constraints and the principle of constructing their perception in order to propose the image of an organization that would make it possible to overcome the paradox of creativity.

9.2. The different types of constraints and their actions

The word constraint has as its Latin origin *constringere* (to bind together closely), a bond that restricts action by tightening it on the object. Constraint is

1 CREA is an annual European conference for sharing and disseminating tools and techniques for creativity.

therefore what restricts, limits or confines within prescribed boundaries (Rosso 2014). The elimination of constraint is often a prerequisite for creativity. However, if creativity must go beyond constraint to be deployed, creative action is well based on the existence of constraints. As such, constraint is not in opposition to creative action; creativity can even be deployed under strong constraint, to find new solutions to new problems. The example of Apollo 13, mentioned in Amabile *et al.* (2002) with regard to creativity under time pressure, and superbly staged in Ron Howard's film (see excerpt from 1 h 16 min and 45 s to 1 h 25 min and 34 s), illustrates well the positive action of time pressure. In the scene where NASA engineers have to save their colleagues from CO_2 asphyxiation, the constraints are extreme: temporal, material and existential. The determination and ingenuity of the team responsible for solving the problem ultimately saved the lives of the three astronauts. This example clearly shows that the constraints are multiple and do not act in the same way on creativity in an organization according to their nature and context. I propose a first distinction between internal constraints, those contained in the problem to be solved and in the cognition of individuals who are confronted with the creative challenge, and external constraints, those that come from the organization and affect creative work.

9.3. Internal design and cognitive constraints

The first category of internal constraints lies at the very heart of the creative issue. Ideation begins with an intention, the resolution of a problem, the desire to change something or to create something fundamentally new. This intention often includes explicit or implicit constraints (Lampel *et al.* 2014). Implicit constraints are integrated or derived from the problem, while explicit constraints are contained in the objective to be achieved when developing new products and services with technical, usage or target market constraints (Rosso 2014). The problems themselves can be very open with a multitude of possible paths to achieve the objective (Fustier 1989), or poorly defined to the extent that the constraints are implicit and the boundaries of the problem space are blurred (Isaksen *et al.* 2000). In the creative problem-solving method, the challenge clarification phase consists of framing the problem, i.e. identifying constraints, and exploring key data (Isaksen *et al.* 2003). The creative design activity is thus a construction of the mental representation of constraints leading to a constrained cognitive environment (Bonnardel 2006). Constraint is therefore an integral part of the ideation; it is this game with constraints that pushes creators to make new associations between matrices[2] according to the principle of bissociation (Koestler 1964). Internal constraints, related to the objective or problem to be solved, can therefore be conducive to creativity. Rosso's

2 According to Koesler, a matrix is a set of skills, techniques and business structures governed by a set of explicit or implicit rules.

study, carried out in the R&D teams of a large company, shows product constraints: expected performance, technology, target customer and intellectual property are conducive to team creativity (Rosso 2014). In this case, these constraints have made the problems clearer and fostered the team's ability to work together toward a common goal. Another study by Stetler and Magnusson (2015) confirms that a high level of clarity in the objectives promotes the generation of innovative ideas.

An individual's creativity is based on specific cognitive resources, i.e. the ways in which information is processed to generate and evaluate new ideas. Divergent thinking is considered as one of the key elements of creativity, and Guilford (1950) breaks it down into four components: fluency, flexibility, originality and elaboration. These four components form the basis of the Torrance Test of Creative Thinking (TTCT) (Torrance 1974). Convergent thinking has also been identified as an important cognitive ability for creativity, especially when it is used in creative processes in association with divergent thinking (Basadur *et al.* 1982). The absence of one of these abilities can be a constraint on creativity as it will limit its expression. However, these creative skills are not innate, they can be acquired through a process of learning based on trial and error and selecting the best results (Campbell 1960). Creativity training can thus improve individuals' creative skills and influence the quantity and quality of ideas generated during brainstorming (Baruah and Paulus 2008). At the level of cognition, the main constraint is more at the level of the functional fixedness. The functional fixedness effect is the taking into account of preexisting elements during a problem-solving task (Duncker 1945). This effect limits creativity because it imposes a framework of perception and a matrix of thought. According to Koestler, "the first condition of originality is the art of forgetting, at the right time, what you know" (Koestler 2011, p. 84). It would appear that the functional fixedness increases with expertise (Bonnardel 2006). At the organizational level, this effect is illustrated by the difficulties that experts in a field have in generating original ideas, and users often have more innovative ideas that can lead to radical innovations (Kristensson *et al.* 2002; Magnusson *et al.* 2003).

Emotion can also be a constraint on creativity. The emotions that activate the cognitive system toward a greater mobilization of attention and effort in the service of action (anger, fear, happiness, etc.) would lead to more creative ease and more original ideas than other types of emotions (De Dreu *et al.* 2008). In an organizational context, a strong appreciation of colleagues leads to greater agreement, tolerance for mistakes and worry about failure, attitudes that constrain the creation and evaluation of ideas. On the other hand, anger leads to criticism of imperfection, correction of mistakes and more spontaneous actions, which increase people's creativity (Yang and Hung 2015). However, in a project team, anger can lead to conflict, prevent debate on ideas, and thus reduce creative production (Isaksen and Ekvall 2010).

9.4. Situational time and resource constraints

Situational or contextual constraints are beyond an employee's control (time, resources, lack of information) and are perceived as a threat, a stressful barrier that negatively affects motivation and performance (Lepine *et al.* 2005). In management science, the context has been identified, since Amabile's (1988) early work as having an effect on creativity, particularly by influencing the intrinsic motivation of creative individuals. Subsequently, Woodman and colleagues (1993), who define creativity as the generation of a new outcome by individuals working together in a complex social system, linked the individual level to the social level to clarify creative processes. Their interactionist model of creativity attempts to model these multiple interactions between the individual, group and organizational level that actively participate in an organization's creative performance (Woodman *et al.* 1993). Organizational constraints, external to the individual, affect motivation and freedom of action to perform creative acts. Among the situational constraints, time and resources are likely to have a negative impact on the creative act (Rosso 2014). However, the action on the creativity of these constraints is contradictory. According to Amabile, time pressure is unfavorable to creativity (Amabile *et al.* 2002). Individuals would thus need time and space to be creative (Isaksen *et al.* 2001). However, Ohly and Fritz's study of architects shows that time pressure is positively related to daily creativity (Ohly and Fritz 2010). This relationship is even stronger when control of daily work is important. Nevertheless, Baer and Oldham showed that this relationship is rather in the form of an inverted U-shaped relationship insofar as employees are open to new experiences[3] and the organization supports creativity; in the opposite case, this relationship is negative. Amabile *et al.* (2002) also observed that if employees had a good understanding of the need for time pressure and could focus on their tasks, then time pressure could be beneficial.

Lack of material and financial resources seems to directly limit the possibilities for creative activity and has a negative impact on motivation (Amabile *et al.* 1996; Rosso 2014). The notion of organizational slack illustrates the importance of maintaining an optimal level of resources for organizational performance. Organizational slack is a stock of unused or underused resources that inevitably tends to accumulate in organizations (Penrose 1959). However, this reserve is important to maintain the proper functioning of the organization (Cyert and March 1963). It acts as a buffer to absorb internal and external shocks, and allows change to be initiated (Bourgeois III 1981). Thus, organizational slack seems necessary for creative work, as Woodman *et al.*'s (1993) hypothesis suggests by linking creative performance with the provision of a pool of resources (Woodman *et al.* 1993,

3 It is based on a personality trait that is part of the five factors model (FFM) that measures the extent to which an individual is motivated to live diverse new experiences (see McCrae and Costa 1990).

p. 314). Cohendet and Simon (2007) have called this type of reserve in creative organizations "the creative slack". However, creative slack is not limited to material and financial resources, it can take the form of knowledge and time that will be mobilized to generate and evaluate ideas. Thus, the periods of work not dedicated to the organization's projects, for engineers at 3M and Google, allow problems and solutions not detected by the organization's traditional routines to be expressed. Ideas and prototypes not used and stored in design organizations, such as Crehaolic or Ideo, also serve as an activatable reserve at any time to solve new problems (Hargadon and Sutton 2000). However, the lack of resources also pushes individuals to be creative in organizations to develop ingenious solutions. Financial constraints may even favor the generation of more original product ideas (Scopelliti *et al.* 2014). The role of material and financial resource constraints on creativity therefore seems to be the same as for time resources, which vary greatly from one study to another. To solve this paradox, Dolmans and colleagues suggest considering resource slack and resource constraints as two extremes of perceived achievable resources. Thus, a resource position assessed as abundant by one entrepreneur may be considered poor by another. They used in-depth case studies of high-tech start-ups to explore the effects of perceived resource slack or constraints on decision making. Their data show that different entrepreneurs perceive the availability of resources in relation to the needs they anticipate. In organizations under resource constraints, individuals can thus innovate, but with working methods adapted to this situation. The Bicen and Johnson (2015) study shows that in start-ups that implement agile lean start-up and design thinking methods, they maximize resource utilization through rapid prototyping and immediate market testing with very short design loops. The availability of resources also has a strong buffering effect on the negative relationship between organizational constraints[4] and practiced creativity (Caniels and Rietzschel 2015). In larger organizations, individuals develop multiple strategies, sometimes creative, to obtain resources for their project: temporary borrowing of resources, long-term security, use of resources considered by others to have little value, amplification of the initial value of one resource, diversion of resources from another project and access to resource reserves through sponsors. In Silicon Valley companies, Kannan-Narasimhan shows that innovators have varied their legitimization strategies according to their resource acquisition strategy. Innovators who have developed resource ingenuity (leveraging underutilized resources) highlight their strategies in the early stages of innovation. They are able to demonstrate to their managers that they are able to maximize the value of unused or underutilized assets. In contrast, innovators employing process ingenuity (diversion of resources from other projects) hide their strategy in the early stages of innovation. They divert resources from officially approved projects. They

4 In this study, the organizational constraints are the 12 KEYS of organizational impediment variables. The KEYS are a set of tool for measuring organizational climates that support the creativity of working groups (see Amabile *et al.* 1996).

deliberately keep their innovations under radar until they are able to provide evidence of the success of their innovation to justify these unapproved diversions.

9.5. Border constraints

The boundary is the demarcation between the organization and its environment that can be established according to four organizational objectives: efficiency, power, competence and identity (Santos and Eisenhardt 2005). If closed, watertight and strictly delimited, the organization's external boundaries are a constraint that limits the creativity of its members. Chesbrough *et al*. (2006) have shown that opening the organization's borders to external sources of ideas, concepts of innovation, knowledge and technology improves companies' creative and innovative capacities. Openness then takes the form of collaborations with other organizations (customers, suppliers, research centers), experts or users. While Chesbrough's analysis is more focused on innovation and does not explicitly mention creativity; much of his work shows that this type of openness brings valuable ideas to the organization and renews the organizations' business models (Parmentier and Gandia 2016). Thus, partially opening the borders of an organization, to a community of users or a brand community, is likely to strengthen its creative capacities by capturing the ideas of users for new uses, products and services, and more particularly among lead users[5] who have been identified as a source of new ideas of value and innovation (Parmentier and Gandia 2013; Parmentier 2015). This openness requires a significant transformation of innovation processes, with the opening and redefinition of the organization's boundaries, the opening of products and services to community input and the redesign of the organization's identity (Parmentier and Mangematin 2014). The integration of organizations within creative territories is also an interesting form of openness for organizational creativity. The competitiveness of a territory would depend not only on the presence of a technology company and research laboratory, but also on the presence of creative classes (Florida 2002; Sleuwaegen and Boiardi 2014) that could feed the creativity of organizations insofar as they open up to the creative underground via clusters (Simon 2009) or competitions (Deschamps and Szostak 2016).

Organizational boundaries are not only external, but also internal, between divisions and departments within an organization. The opening of internal borders also has an effect on an organization's creativity. It can be more creative by simultaneously mixing exploitation and exploration activities (Parmentier and

5 Lead users are users at the forefront of a domain, with a strong interest in innovating for themselves, imagining and developing solutions that meet expectations that will later become widespread to all users in the domain (see Von Hippel 2005).

Mangematin 2009), and by integrating members who develop weak ties in intermediary situations within social networks (Perry-Smith 2006). Similarly, the presence of a community of practice, transversal to the organization, is likely to serve as a pool of knowledge and ideas to renew an organization's products and services (Cohendet and Simon 2007).

Thus, all these phenomena, which are located at the organization's internal and external borders, feed the creativity of its members and influence its creativity and innovation processes. However, openness cannot be complete, the ideas of users and the underground must be evaluated, and transformed according to the strategic objectives of the organization. Innovation with a community of users can even be confrontational and unproductive (Dahlander 2008) if there is no common goal and no value sharing with users (Parmentier and Mangematin 2014). Moreover, in collaboration with other organizations, too much openness can limit the capture of the value of ideas due to opportunities, the management of intellectual and industrial priority rights or inequalities in income distribution (Chesbrough *et al.* 2006; Chesbrough and Appleyard 2007). The border is therefore both a constraint for creativity, but it is also a necessary protection to ensure the successful implementation of ideas.

9.6. The construction of the sense of constraints

We have seen that external constraints can in some cases encourage the creativity of individuals and groups, while in other cases it is the opposite. This apparent paradox is rooted in the interpretation of constraint, which affects motivation. Ford's evolutionary model of creativity, which identifies the factors that intentionally lead the individual to take creative action, takes into account the interpretation of context. In this model, the factors that constrain and facilitate individual creative action influence sensemaking, motivation, knowledge and capacities. Ford limits the factors that influence sensemaking to the orientation of individuals to see problems from multiple angles (problem interpretation). However, there are many studies that support this hypothesis of the phenomenon of sensemaking in creative activity. Caniels and Rietzschel (2015), in their study on the effect of organizational constraints on creativity, distinguish between creative potential and practiced creativity. Creative potential is the belief in one's ability to produce creative ideas and creativity and practiced creativity is the perception of opportunities to use one's creative skills. Organizational obstacles have a strong influence on practiced creativity, so the individual thinks that they cannot use their creative capacities in their work (Caniels and Rietzschel 2015). Roskes' (2015) study, which examines the effect of the type of motivation on the action of constraints, which limit or channel cognitive resources, on creativity, reinforces this hypothesis. Individuals who are motivated to achieve an objective are more tolerant

of constraints that limit cognitive abilities (noise, time, disturbances, etc.) than individuals who are motivated to prevent failure or loss (Roskes 2015). Similarly, in the study already mentioned by Baer and Oldham (2006), the effect of time constraints is moderated by support for creativity and orientation toward new experiences. Constraints are therefore not perceived in the same way depending on the context. An organizational climate conducive to creativity would therefore have a moderating effect by changing the perception of constraints.

9.7. Organizational climate

Organizational climate is a series of recurring behaviors, attitudes and feelings that characterize the life of an organization (Ekvall 1991). Climate, by influencing individual and organizational processes such as communication, coordination, learning, motivation and problem solving, affects the productivity of work teams and the creativity of individuals (Isaksen and Lauer 2002). Nine relevant dimensions have been identified to measure the existence of an organizational climate conducive to creativity, and grouped together in the situational outlook questionnaire (SOQ) after multiple empirical and theoretical studies (Ekvall 1991, 1996; Lauer 1994). The organizational creative climate is measured with 45 questions: the level of challenge and involvement, the degree of freedom, trust and openness, the time dedicated to exploring ideas, humor and fun, the level of conflict, the support of ideas, the level of debate and risk taking. Conflict has a negative impact on the creativity of teams, while the other eight dimensions have a positive impact. The creative climate thus appears as a kind of interesting "proxy" to characterize contextual variables and their effects on the creativity of members of an organization. With the same logic, the work of Amabile *et al.* (1996) led to the development of the KEYS measurement scales to assess whether the working environment is conducive to the creativity of working groups. The KEYS measurement scales include 87 questions divided into eight dimensions: four concern management practices (autonomy/freedom, managerial encouragement, group support and interest in the challenge), two organizational motivations (organizational incentives and absence of organizational barriers) and two resources (sufficient resources and workload). The KEYS were validated only at the group analysis level and the SOQ was validated at the individual, group and organizational level (Isaksen and Lauer 2002).

We propose to link the dimensions of KEYS and SOQ to organizational dimensions (structure, resources, vision and missions and management methods), thus defining the image of an organization with a climate conducive to creativity, which reduces the negative impact of constraints and increases their positive effect. In the following, we will call such an organization a creative organization.

Organizational dimensions	Factors in creative organizational climates
Structure	Autonomy/freedom (KEYS) Degree of freedom (SOQ) Risk taking (SOQ)
Resources	Organizational incentives (KEYS) Absence of organizational barriers (KEYS) Adequate resources (KEYS) Workload (KEYS) Time dedicated to the exploration of ideas (SOQ)
Visions and missions	Interest in the challenge (KEYS) Level of challenge and involvement (SOQ)
Management methods	Managerial encouragement (KEYS) Trust and openness (SOQ) Conflict level (SOQ) Level of debate (SOQ) Humor and fun (SOQ) Trust and openness (SOQ) Support of ideas (SOQ) Group support (KEYS)

Table 9.1. *The organizational dimensions of creative climates*

The organizational dimensions of creative climates reflect the image of an organization that is conducive to creativity and a positive perception of constraints, with a clear, interesting and motivating vision shared by all employees; a structure that promotes freedom and autonomy, sufficient and creative resources to develop creativity, a supportive rather than controlling management style and a group life based on dialogue, sharing, trust, tolerance and fun. This creative organization respects the three principles of building an innovative organization: fluidity, integration and energy (Dougherty 2008). Fluidity defines and puts work into practice as a practice of innovation, integration organizes work into horizontal flows of innovation problems and solutions, and energy energizes work through social relationships and worker empowerment becomes the central element. For Dougherty, an organization based on these three principles makes it possible to reconcile constraints and actions. Creative organization is quite similar to the organizational type that is conducive to creativity identified by "why" companies as opposed to "how" companies (Getz and Carney 2013). In "why" companies, even if there is an organization chart, employees are encouraged to be autonomous to solve

daily problems themselves. In such an organization, leaders do not say how to do the work, but rather why. The entire company organizes itself into a small team to achieve the objectives of an ambitious vision shared by the majority of employees. This organizational structure creates individual and organizational flexibility, which is necessary for creativity and innovation (Georgsdottir and Getz 2004). This organizational climate is also found in communities of practice and user communities, which integrate creative individuals and reserves of knowledge, practices and ideas necessary for the generation, socialization and integration of ideas (Cohendet and Simon 2015).

9.8. Conclusion

Constraints convey and channel creativity in an organizational climate that is conducive to creativity. What is perceived as an impassable and demolishing limit in a hierarchical and controlled organization becomes a challenge and a source of creativity in more agile organizations. The organizational climate conducive to creativity fosters the development of positive motivation and opportunities for knowledge exchange between individuals, multiplying the likelihood of the emergence of valuable ideas. In such a climate, creativity under constraint is no longer a paradox. Of course, there is a level of constraint that should not be exceeded. Time constraints limit procrastination, but in a certain way they prevent action and thus negatively affect individual creativity. Similarly, below a level of resources, regardless of the organizational ingenuity of individuals, it will be difficult to concretize and validate ideas. The excessively strong constraint may ultimately degrade the organizational climate and have an even greater impact on the creativity of teams. Managing creativity therefore requires developing a high sensitivity to the organizational climate, giving meaning to objectives, and using constraint in moderation and making it a challenge and a lever for team creativity.

9.9. References

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10

Creativity for Extreme Situations

10.1. Introduction

Referring to the September 11 attack in 2001 on the World Trade Center, David Stark (2014) indicates that each 'normal day' is 'normal' in a similar way, but that each disaster is completely unique. With each new disaster, economic or environmental crisis, we are surprised not to have thought about it before or not to have predicted its magnitude (Burt 2007). As journalist Warren Brookes pointed out about erroneous predictions[1]:

> "This is like forecasting partly cloudy and getting a ten-inch snowstorm instead. After all, in economics as in meteorology, it's the ability to predict stormy change that makes forcasting useful." (Wack 1985, p. 75)

It is, of course, impossible to predict all adverse events in advance and illusory to have the ambition of zero risk. Managing the unexpected is what belongs to human beings and marks their superiority over technical systems (Hitchcock *et al.* 2009; Boy 2013). Indeed, in a dynamic, uncertain and risky context, problem solving and decision-making are all the more difficult, because neither the designers of the technical system, nor the operational staff have planned a procedure to deal with an adverse and unexpected event. "Checklists and do-lists are designed to deal only with "known" situations" (AAE 2013, p. 13). Experts agree that extreme situations, where the safety of people and facilities is threatened, require management that

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1 In the summer of 1981, five of the most prestigious economic forecasters predicted 2.1% GDP growth in the United States for 1982. Instead, the economy plunged into a deep recession, with a 1.8% decline in GDP.

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combines creativity and reliability. In extreme and unprecedented situations, creativity is the key (Orasanu and Fisher 1997; Boy 2013; Klein 2013). But what do we mean by creativity in extreme situations? Is there really a place for creativity in risk management? What skills do you need to be creative in the face of the unexpected? How can we prepare for the rare or unknown event? Is it possible to imagine the unthinkable to anticipate it? What is the role of creativity in developing disaster scenarios?

This chapter will attempt to answer these questions by drawing on the psychology of creativity, and models of risk management and decision making in extreme situations encountered by experts in high-risk fields such as nuclear, aviation, military strategy, etc. It includes three sections, the first of which is devoted to an introduction to creativity. The second is dedicated to the role of creativity in extreme situations and in everyday risk management, and finally, the third section addresses the preparation and anticipation of unforeseen events through the imagination of original scenarios. It does so by drawing inspiration from the creative processes of fiction writers and integrating recent work on creativity in the virtual environment, thus opening new perspectives in the anticipation and management of crises and extreme situations.

10.2. Introduction to creativity

10.2.1. *Definition of creativity*

Creativity can be defined as the ability to generate new original production adapted to the constraints of reality (Lubart *et al.* 2003). Although the notion of intelligence emphasizes analytical skills, the use of prior knowledge and problem solving through the use of routine procedures, creative problem solving involves the ability to make non-obvious connections and the ability to generate new solutions previously unknown (Sternberg 1985; Lubart *et al.* 2003). A problem can be defined[2] as:

> "A situation for which the organization has a purpose, but does not have a known means to achieve it. Three attributes characterize a problem to be solved: the existence of a gap between the present situation and the goal to be achieved; the absence of an obvious path leading to the reduction of this gap; and the subjective and circumstantial nature of the problem solving."

2 http://edutechwiki.unige.ch/fr/Résolution_of_problem.

Thus, artists who seek to express their feelings, scientists who try to understand a complex phenomenon and people who have to deal with everyday conflicts are all considered to be involved in solving a problem.

Creative potential is widely distributed in society according to four levels of creativity (Kaufman and Baghetto 2009). The first level, or mini-c, corresponds to transformative learning experiences observed in young children and students that can be expressed through reflection, fun and surprising observation or an original reproduction of something that has already been invented. The internalization of learning and experience contributes to personal creative development. The second level, small-c, corresponds to everyday creative activities, limited to a limited personal, family and professional circle, such as transforming a family photo album into an original scrapbook, combining the remains of a meal to produce a new dish, developing a creative solution to a complex schedule at work, etc. The third level, pro-c, concerns creativity recognized in the professional world and used in one's work as do writers, chefs, engineers, doctors, civil and military airline pilots, etc. Finally, at the top, there is the fourth level or "big-C", concerning the eminent creative people whose contributions form the basis of our culture, such as artists, writers, musicians, etc., or people who have had an impact on society through their scientific discoveries and inventions (Albert Einstein, Sigmund Freud, etc.). According to the multivariate approach, creative potential is the result of the juxtaposed effects of several distinct, specific and cumulative resources such as intellectual abilities, knowledge, personality traits, motivations, emotions, physical or social environments (Sternberg and Lubart 1995; Lubart 1999; Lubart *et al.* 2003, 2013). Creative thinking requires a particular combination of cognitive and conative factors:

– cognitive domain: divergent thinking, analytical thinking, mental flexibility, associative thinking, selective combination;

– conative domain: tolerance of ambiguity, risk-taking or daring, openness, intuitive thinking, motivation to create.

10.2.2. *Creative processes*

Creative potential remains latent until it is solicited in a creative activity taking place in a favorable environment. This is followed by the application of a succession of thoughts and actions called creative processes.

There are three sources of information about the creative process. The first, based on the introspection of eminent scientists such as Poincaré and Helmholtz, enabled Wallas to propose in 1926 a model of the four-stage creative process that

remains a reference in the field: preparation, incubation, illumination and verification.

Preparation includes information gathering and preliminary analysis to define the problem. This is a conscious and often long-term process that requires analytical skills and knowledge of the problem. This initial work can lead to a dead end. This is followed by an incubation phase where there is no conscious work on the problem. The person stays away from the problem, can move on to another project or relax. But the brain continues to work unconsciously on the problem, forming associations: the unconscious rejects most of these associations as useless, but sometimes finds a promising idea.

A phase of frustration may occur after the preparation phase. The person may be blocked when analytical skills reach their limits in dealing with the problem. They can then either continue at the risk of falling back into the same impasse and accepting an unsatisfactory solution, or go further, explore other possibilities, move in a new direction. This creative frustration can also precede the flash of illumination.

Illumination (also called eureka or insight) occurs when an interesting idea becomes conscious like an apple on the head at the most unexpected moment. An idea emerges from the mass and makes it suitable for creation. This is a high point where "the brainwave" takes place.

Finally, verification makes it possible to evaluate, redefine and develop the idea. If there are any imperfections, the person goes back to the previous steps to find a more satisfying idea.

Since then, several other models have emerged, introducing modifications and improvements to the Wallas model (for a summary, see Lubart 2003).

The second source of information on creative processes is a guided approach, structuring the work, such as the Creative Problem Solving (CPS) model. The CPS was introduced in the 1950s by Alex Osborn in his book *Applied Imagination* and includes six to eight steps according to versions. This model has had a great influence on several researchers and practitioners who have applied and advanced Osborn's original ideas. Parnes *et al*. (1977) equated CPS with creative decision making. Isaksen and Treffinger (1985) have argued that creative problem solving begins with a disorder phase (mess) during which the problem is defined. They distinguish between the discovery phase of the problem (something is wrong, unsatisfactory or missing) and the preparation phase in which information is collected. The CPS is divided into three main steps: understanding the challenge, preparing for action, and planning the process. These steps are further divided into substeps that vary slightly depending on the version.

Finally, the third approach is to explore creative processes through observation, follow up and analysis of creators' logbooks. For example, in a recent study, the use of this approach allowed us to develop a model of the creative process involved in scriptwriting. This model is not linear, but is rather iterative with several feedback loops combining intuition, insight, mental representations, problem solving and decision making (Bourgeois-Bougrine *et al.* 2015). After the problem definition and action plan phases, the writing–rewriting phase begins. This writing phase is similar to the crossing of a labyrinth with branches, dead ends and false tracks. This crossing takes place at times in an intuitive way in automatic mode and sometimes becomes laborious requiring us to go backwards, revising the initial plans, considering new alternatives, etc.

As he writes, the screenwriter rereads the text and may realize that "it is not tenable", that he is in a dead end, etc.; the loss of a coherent global vision could explain the mental blocks and the frustration that results. Problem solving requires hindsight and mental flexibility to overcome the impasse, changing the terms of the problem and updating the mental representation of the narrative. This phase is rich in insights or illuminations that open up new perspectives. The new choices made, by the "domino" effect, will require the use of what is already written to replace, add, delete or move certain scenes and dialogues for a more coherent and satisfactory structure.

The writers' discourse suggests that they use their experience to automatically or unconsciously assess the situation and that they have developed an ability to remain aware of everything that is happening simultaneously and to integrate this awareness into their scriptwriting activity. Indeed, experience shows that certain processes as complex as creating a story or adopting the 90-minute pace of a feature film become automatic and are unconsciously realized. Scriptwriters say they are very intuitive in their choices and this is accompanied by a feeling of evidence and accuracy without being able to justify them. Intuition is a cognitive mechanism that works by associating a piece of information provided by the situation with information stored in memory. Intuition is nothing less than recognition.

The creative processes described above are reminiscent of those involved in naturalistic decision-making models in which intuition plays a fundamental role. These models will be discussed in section 10.3 to explore creativity in everyday and extreme situations.

10.3. Creativity and risk management

Threatening situations lead to both vigilant behavior and a focus on the threat to escape quickly. This sustained effort can lead, in some cases, to the creation of a

new solution to a problem never before encountered (Orasanu and Fisher 1997; Boy 2013; Klein 2013). But in other cases, stress due to the surprise effect in unexpected and dangerous situations, can lead to a decrease in creativity, phenomena of fixation and perseveration, and even in extreme cases lead to the phenomenon of sideration, often referred to as "cognitive blank" (Mehta and Zhu 2009; Friedman and Förster 2010; Förster and Dannenberg 2010; AAE 2013, p. 13). The experience, intuition and creativity of front-line actors are decisive, as we will see below. The following models reflect the strategies used by experts in extreme situations where time is limited and information is incomplete and sometimes contradictory. Data and objectives change dynamically making analytical and rational decision-making very difficult or impossible. For the naturalistic approach, intuition is the central mechanism of any complex decision-making process.

10.3.1. *Creativity, insight and intuition when making decisions in extreme situations*

The only model, to our knowledge, that makes an explicit link between creativity and decision making in critical situations is the one developed by Orasanu and Fisher (1997, 2010). It is based on the analysis of three sources of information: simulator observations, NTSB (National Transportation Safety Board) accident data and incidents reported confidentially by crews in the ASRS (Aviation Safety Reporting System) database. The Orasanu and Fisher model is also based on two well-known models:

– Rasmussen's SRK (skill–rule–knowledge) model, which represents the possible paths of cognitive processes between three levels of behavior, namely the skill-based behavior level, the rule-based behavior level and the knowledge-based behavior level. The first level involves the implementation, without conscious attention, of cognitive automatisms (mental calculation, routine management, etc.). The second level is defined by a conscious control based on a stock of rules acquired through experience (if "X", then "Y"). The third level involves problem-solving activities with a situation analysis phase (activation, observation, identification, interpretation or diagnosis) and an action plan and assessment phase to assess the state toward which the system should tend toward (task definition, procedure formulation and execution);

– the Klein recognition primed decision-making (RPD) model (1993) indicates that the expert decision-maker instinctively compares the situation with previous experiences. If the situation is familiar, they will refer to the action plan implemented previously and make a mental simulation of the identified solution to assess its consequences. If the solution considered is not appropriate for the situation to be managed, the decision-maker then imagines another solution and performs a new mental simulation, and often stops at the first satisfactory option. According to

Gary Klein (2004), intuition is the way we translate our experiences into understanding the situation and then making decisions.

Orasanu and Fisher's model considers that crew decision making in the face of a threat consists of two main components: situation assessment and action plan selection. Situation assessment involves defining the problem, assessing the level of risk and determining the time available to solve the problem. The action plan includes three types of solutions: rule-based application, choice of one of several alternatives and creative problem solving. In all three cases, the crew's experience and knowledge are decisive in deciding, on the basis of the available evidence, whether the situation is familiar or not and the nature of the action plan to be implemented.

The first action plan, rule-based, consists of implementing the rules prescribed for high-risk situations, such as smoke in the cockpit or rapid decompression. These abnormal situations are considered to be sufficiently consequential for the procedures to be specified.

The second action plan based on the choice between several alternatives is far from considering all options as in rational analytical analyses. Decision-makers are looking for the most satisfactory compromise and not the most optimal too. They often eliminate options based on a characteristic.

The third action plan is to create a solution and implement it when problems are poorly defined or ambiguous. If the situation is not very clear, a diagnosis is undertaken, but only if time permits. If the risk is high and time is limited, action can be taken without a full understanding of the problem. Two strategies are, therefore, possible depending on the situation and the time available: procedural management and creative problem solving. Procedural management consists of treating the situation as an emergency without seeking to clearly define the problem. The clues indicate the existence of a problem, but its nature is not defined. The solutions created are intended to escape the situation as quickly as possible. Creative problem solving is considered by Orasanu and Fisher to be the most difficult type of decision. It is not only a matter of diagnosing the situation, but also of creating a solution for a problem that has been defined but never encountered. The following two examples were used by Orasanu (2010) to illustrate procedural management and creative problem solving, respectively.

On January 15, 2009, the crew of US Airways A320 decided to land on the Hudson following the loss of thrust in both engines after striking a group of Canada Geese. Each engine had "ingested" at least two of these large birds (approximately 3.6 kg). This accident is an example of successful extreme situation management as the checklists were not appropriate (they were not intended for the loss of both

engines at a low altitude of the aircraft, 850 m) and the size of the birds that damaged the engines was greater than the maximum (1.8 kg) for which the aircraft engine had been certified (NTSB report[3], 2010).

On November 22, 2003 in Baghdad, a cargo aircraft operating for DHL and registered in Belgium was hit by a missile fire at nearly 10,000 feet[4]. The fire caused the loss of the three hydraulic systems that controlled the aircraft. The crew then decided to attempt to land the aircraft by adjusting the engine power individually. The accident had a huge impact in the press, as it was the first time in the history of commercial aviation that a crew landed without hydraulic controls.

In order to understand how people create new solutions, Klein and Jarosz (2011) conducted a naturalistic study of insight. It is worth noting the distinction between intuition and insight. Intuition, as we have seen above, corresponds to an association between a piece of information provided by the situation and information stored in memory. Insight, on the other hand, corresponds to a sudden reorganization of the elements of the problem that corresponds to a transition from one mental model to another that is more satisfying, bringing suggestions for new actions that can remedy the tensions inherent in the previous mental model. Klein and Jarosz selected and analyzed 120 examples of problem solving through the insight of problems in various fields: military, medicine, finance, science, invention, business and management. The objective was to analyze the behavior of the people involved and the causes or factors that trigger and facilitate the insight phenomenon. This analysis allowed them to develop a three-way model leading to insight:

– connection path: the majority of insight examples (82%) were triggered when the person, engaged in the problem-solving process, noticed a connection between different elements or data and a brainwave;

– contradiction path: identifying inconsistencies or contradictions between different pieces of information, in one's own beliefs or those widely accepted by others, was at the origin of 38% of the examples of insight. Instead of ignoring contradictions, the person becomes suspicious and explores the ramifications of the contradiction;

– creative desperation path: triggered in a situation of extreme danger, when the individual is confronted with an impasse resulting from deliberate and often desperate efforts to escape it (25% of incidents include an impasse). The classic example of creative despair is Mann Gulch's 1949 fire, where team leader Wagner

3 NTSB (2010). *Loss of Thrust in Both Engines After Encountering a Flock of Birds and Subsequent Ditching on the Hudson River US Airways Flight 1549 Airbus A320-214, N106US*, Weehawken, NJ, January 15, 2009. Accident Report NTSB/AAR-10/03 PB2010- 910403.

4 https://en.wikipedia.org/wiki/2003_Baghdad_DHL_attempted_shootdown_incident.

Dodge, caught by an explosive fire when climbing a steep slope, decided to light the fire in front of him and ordered in vain his teammates to lie down in the burned area where a new fire could not catch. He was saved. The fire killed 13 of his teammates.

Insight or revelation requires a certain mental flexibility to generate a new interpretation of the problem and to restructure it. Mental flexibility is a component of creative thinking (Lubart *et al.* 2013) that corresponds to the ability to consider several points of view on the same object, i.e. to consider several means to achieve the same goal. Faced with a problem, the subject can produce a first interpretation and a solution that leads to a dead end. According to Clément (2006, p. 423), flexibility is "triggered by a signal of the situation: the impasse". The most elaborate form of flexibility is:

> "The ability to question the interpretation of the situation and to carry out a new analysis by recoding the properties of the situation. In this case, the impasse is sufficient to change representation and strategy. It is in an impasse, when no further action seems possible, that reactive flexibility can manifest itself. It results from a reorientation of attention triggered by a signal from the environment to properties that were not in the attentional focus. Voluntarily controlled processes then allow for goal change and impasse resolution."

10.3.2. *Creativity and daily risk management*

The occurrence of an unexpected situation means that it had not previously been identified during the quantitative risk management process and therefore no action had been taken. Quantitative risk management is based on the combination of the probability of an adverse event occurring and the severity of its consequences. The resulting criticality matrix allows gradings to be made and priorities to be set on the measures to be taken to reduce risks and combat their consequences. A situation that can have very serious consequences requires the implementation of preventive measures as a matter of priority, even if the probability of its occurrence is very low. Indeed, the control of occupational and environmental risks is strongly based on the reduction of error and uncertainty through quantitative risk management, implementation and compliance with regulations, procedures and standards issued by governments, insurers and standardization and certification bodies.

According to Klein (2013), organizational safety performance is an equation that combines two variables: error reduction and insight increase. The ability to adapt and be creative requires not only knowledge but also an open, active, insightful and curious state of mind to detect anomalies and contradictions, weak signals, make connections, identify coincidences and implications and leverage action. By seeking

to reduce errors and control uncertainty, most organizations focus employees' attention and energy on implementing and adhering to procedures and standards at the expense of insight.

It is common to wrongly consider that unexpected situations are exceptional and this is rooted in the probabilistic approach described above (Boy 2013). On the other hand, operators manage the unexpected all the time in their daily activities because the real situation is not always as they expected. Indeed, the variation between the expected situation and the actual situation is frequent and random; most of the time this gap is small and it is treated fairly easily but in some cases, the gap can be much larger. Managing these gaps, whatever the size, requires flexibility, adaptability and creativity, thus contributing to optimizing the resilience of the system.

The resilience of sociotechnical systems, according to Stark (2014), corresponds to the ability to bounce back after a shock and to learn from it. To explain resilience, he uses the metaphor of the immune system, which needs small shocks to learn and be ready to respond to larger shocks. The small daily variations between the expected and actual situation could be considered, in the context of this metaphor, as the inoculation of germs in small doses to increase resistance during larger shocks. This acquired immunity, the result of lessons learned from the very vulnerabilities of the sociotechnical system, forms the basis for the accumulation of knowledge and experience that allows us to be creative and adaptable in extreme situations.

Thus, in day-to-day risk management, preventive measures to reduce errors and accidents must be highly flexible and adaptable to change in the environment.

Thus, in addition to the human capacities that are controlled at selection, the technical and non-technical skills (CRM) developed during initial training, specific training activities should be developed in each risk domain in order to (a) adopt a "spontaneous" mental flexibility that reflects the ability to anticipate outside urgent action or impasses on several points of view on the same object (Clement 2006; Bougeois-Bougrine 2015) and (b) to stimulate the ability to adopt a creative mental functioning mode in extreme situations. Section 10.4 presents approaches that could stimulate the creation of new scenarios for preparing for extreme situations.

10.4. Creativity for anticipating extreme situations

It is of paramount importance to think creatively about future events, otherwise the surprise effect will be multiplied by lack of preparation. Stark (2014) makes the distinction between planning and preparation, because planning requires that all parameters be known in advance. So you can't plan for what is radically unknown, but you can prepare for it.

Since the future is uncertain, we must prepare for various futures: possible futures, probable futures and preferable futures (Börjeson *et al.* 2006). These authors have identified three types of scenarios, predictive, exploratory and normative, that try to answer three questions respectively: "What will happen?, What can happen? and How can a specific target be reached?" (Börjeson *et al.* 2006, p. 3).

The scenarios contain the stories of these multiple futures in a form that is both analytically coherent and imaginatively engaging (Bishop *et al.* 2007). According to these authors, a good scenario grabs us by the collar and says, "Take a good look at this future. This could be your future. Are you going to be ready?" (Bishop *et al.* 2007, p. 5). The worst-case scenario, therefore, consists of imagining the worst and identifying the actions to be implemented.

In France, the purpose of foresight is not to predict the future or to reveal it as if it were something that already exists, but rather to build it (De Jouvenel 2002). Foresight uses rigorous quantitative, qualitative, normative and exploratory methods. These methods help to scan the field of possibilities, identify key variables and future issues, reduce uncertainties about the future, and make strategic decisions and actions about the future.

The collaboration required to produce scenarios is subject to a number of biases that may hinder the activity of generating ideas or have negative effects on the activities of evaluating and selecting solutions, at the risk that creative solutions will not be retained by the group.

In the following sections, we will present two approaches designed to facilitate the generation of solutions by drawing inspiration from fiction writers, and finally by using the virtual environment to remove certain obstacles to creativity. These approaches are complementary and interrelated, but for clarity we present them in separate sections.

10.4.1. *What can we learn from fiction writers?*

Imagining future event scenarios requires a combination of creativity and expertise. To stimulate the imagination, it would be wise to use science fiction writers or at least to draw inspiration from the creative processes of writers and scriptwriters.

Referring to the book *An Aura of Familiarity*, Rémi Sussan[5] (2013) reports that using science fiction authors, as does the Institute for the Future in Silicon Valley

5 http://www.internetactu.net/2013/09/12/prospective.

(IFTF), is a source of inspiration that goes further "not only in imagination, but also in the precision of reflection, than serious trend reports – which are often much poorer". The IFTF's practices, which happily combine art, games, science and technology, can disconcert the supporters of a more "classical" foresight. Indeed, for research work on the futuristic theme of "Networked Matter", Pescovitz (2013), Director of Research at the IFTF, not only consulted scientific journals and created workshops with experts in the fields of the "Internet of Things", "biotechnology" or "nanotechnology", he also solicited six science fiction writers[6] to write fiction on their research theme. Pescovitz (2013) indicates that science fiction has always been a place of technological innovation, even inspiring submarine and cell phone inventions.

What is the creative process of fiction writers or scriptwriters? What lessons can we apply to stimulate our creativity when imagining scenarios?

The interviews we conducted with experienced scriptwriters show two elements that, in our opinion, are decisive for creativity: impregnation and identification with the main characters (Bourgeois-Bougrine *et al.* 2015). During the impregnation period, which can last from a few weeks to a few months before writing begins, the scriptwriter tries to understand the core of the project, define the problem, explore the motivations for telling the story, etc., through discussions with the sponsor. According to McCrea *et al.* (2008), abstract thinking and the imagination of original alternatives are promoted when a project is considered under the term "why?" and not "how?" (why *versus* how to tell the story). Impregnation also includes the massive (and sometimes disproportionate) collection of information. In this phase, it is a question of many desires and openness to everything that comes through readings, visits to galleries, consultation of archives, photos, films, experts, etc. Writers take the time to dream, imagine situations, think about what they want to tell, postponing writing, etc. This period of procrastination is associated with intense mental work that will be decisive for the creative process during the development of scenes and dialogues.

Indeed, Nancy Andreasen's (2011) studies examining the brain through functional MRI suggest that periods of reverie would activate the associated areas of the brain involved in memory, introspection and the imagination of several alternatives. Further research (Buckner *et al.* 2008; Buckner 2012) has shown that activating these areas would be dedicated to building dynamic mental simulations based on personal past experiences, thinking about the future, imagining alternatives and scenarios.

6 Cory Doctorow, Rudy Rucker, Warren Ellis, Madeline Ashby, Ramez Naam and Bruce Sterling.

In addition, familiarization with the characters begins during the impregnation phase through the development of their detailed biographies or even a first-person diary (although not all elements will be used later). During the writing phase, the scriptwriter puts himself in the character's shoes and begins to make him "speak and act". This identification with the characters encourages inspiration, new ideas and solutions as indicated in the following excerpt from the interview:

> "Sometimes, indeed, a character that we have created, or half created, escapes you... There comes a time when, when history is being built, people begin to have a certain logic of functioning that can then lead to new situations and advance the story".

Thus, the imagination of new scenarios requires a long period of impregnation including questioning, documentation, daydreaming, etc. Identification with characters "feeds" intuition and leads to this mental state, called flow, characterized by deep concentration and engagement as if they are carried by the current in a river (Csikszentmihalyi 1996). Character embodiment is similar to the Proteus effect that we will discuss in section 10.4.2.

10.4.2. *Co-creativity in a virtual environment*

In his article entitled *Red Ideas: In Praise of Divergent Thinking*, Matt Cavanaugh (2015) – a strategist in the U.S. military and a member of the Modern War Institute – reports that in the "art of war", divergent exceptional thinking is rare but that the courage to express "red" ideas that diverge from conventional wisdom is even more so. He indicates that the strong hierarchical relationship in the army is one of the reasons that can make the lowest ranking people reluctant to express their ideas and reservations when thinking and developing alternative scenarios for "D-Day". In addition, the imagination of new scenarios can be hindered by cognitive biases, including the mirror imaging effect, which instinctively leads analysts to assume that their opponents or enemies would think like them in the same circumstances (Zenko 2015).

In addition to these biases, the co-creativity of scenarios may suffer from what has been called group productivity loss (Diehl and Stroebe 1987) due to factors such as production blockage, apprehension of evaluation, fixation, social laziness and group thinking. These difficulties are caused by the "classic" ways of generating solutions in a real physical environment, namely the oral mode of generating ideas, the lack of anonymity and the visibility of all solutions (Richard 2016).

Multiuser virtual environments (MUVEs) can be an alternative to overcoming these difficulties. Indeed, virtual environments make interlocutors anonymous (or

confidential) and physically isolated, resulting in improved individual and collective creative performance in collaborative tasks. Individuals may dare to take risks and propose creative solutions that they would not have been able to express if they had been personally identifiable. Indeed, the recent studies we have carried out as part of an ANR project called CREATIVENESS[7] (Burkhardt and Lubart 2010; Thornhill-Miller and Dupont 2016) show that co-creativity is promoted in virtual environments over a real environment in terms of the number and originality of ideas and solutions produced. In both real and virtual environments, participants did not know each other and the meeting rooms were identical (faithful reproduction of the real meeting room in the virtual environment). The participants, whose creative profile was characterized by a great "propensity to dare" or to take risks wisely and appropriately, devised more and more original solutions in a virtual environment, whereas in a real environment this tendency to take risks had not been expressed. Thus, the creative potential may remain latent in a real environment, even if it is solicited in a creative activity, while the anonymity and physical isolation of participants in the virtual space causes a decrease in inhibitions to explore unconventional ideas.

In addition, in the context of MUVEs, the use of avatars makes digital representation of the self-flexible: participants can personalize their avatar in terms of physical appearance, social identity and gender. Several studies have been able to understand the influence that the appearance of virtual characters can have on the behaviors, attitudes and creativity of users who interact in a virtual environment. For example, participants who were represented by avatars whose appearance was reminiscent of "inventors" produced more innovative ideas than those who had "neutral" avatars (Buisine *et al.* 2016; Guegan *et al.* 2016). Similarly, an avatar representing a member of the Ku Klux Klan (KKK) negatively influenced the content of the story produced by its user (Peña *et al.* 2009). This effect is known as the "Proteus effect" after the god of Greek mythology who possessed the faculty of metamorphosis (Yee and Bailenson 2007, 2009). Two theories could explain the Proteus effect (Buisine *et al.* 2016; Guegan *et al.* 2016):

– self-evaluation: according to this theory, participants are particularly sensitive to the social cues associated with their new identity that they infer from their avatar. They are considered as taking the position of an external observer: based on external clues, they will self-influence and rationalize their behavior in the sense of the identity constituted by the avatar;

– priming: the avatar is likely to activate concepts in the memory that are associated with appearance. Indeed, since cognitions are organized in a knowledge

7 CREATIVENESS (*Creative activities in virtual environmental space*): ANR project (contract no. ANR-12-SOIN-0005-02).

structure, the activation of a certain concept/sterotype (e.g. KKK) can activate the associated information networks (e.g. racism, aggression and violence) influencing the individual implicitly at the behavioral level. This would activate networks close to the concept initiated and inhibit distant networks (e.g. kindness in the case of the KKK).

The undeniable benefits of the virtual environment in stimulating creativity could be explored for the development of a Red Team-type crisis or attack scenarios. Indeed, many civilian and military organizations recruit external teams or Red Teams to play the role of devil's advocate[8], challenging beliefs, anticipating threats and testing the vulnerability of their site by conducting online or real intrusion attacks (Zenko 2015). The anonymity offered by the virtual environment, as well as the Proteus effect linked to the digital representation of the self would make it possible (a) to overcome the mental blocks, fixations as well as the cognitive biases associated with meetings in a real environment, and (b) to embody the enemy through a personalized avatar in order to think like him, the purpose being to imagine and anticipate his next attacks. The scenarios thus imagined in a virtual environment would serve as a basis for training and education in the management of extreme situations.

10.5. Conclusion

To the question of whether creativity has a place in regulated and procedural environments, where error can have serious consequences: the answer is positive because procedures and rules are effective in the case of known and previously identified situations but become obsolete for extreme and unexpected situations. Creativity consists of finding a new solution adapted to a complex, dynamic and unexpected situation. This requires a certain mental flexibility to generate a new interpretation of the problem and to restructure it to consider several ways to achieve the same goal. Creativity is also involved in imagining crisis scenarios, creating barriers to avoid the occurrence of adverse events and developing procedures to prevent their spread and manage the consequences of incidents and accidents, if necessary.

The dossier of the *Académie de l'air et de l'espace* (French Academy of Air and Space), developed following the 2011 symposium *Les pilotes de transport aérien*

8 Devil's advocate: a term that applies to anyone who is skeptical and defends an unpopular and contradictory position. During the first millennium, the Catholic Church introduced the title of devil's advocate, whose function and responsibilities were to question and challenge the virtues and miracles of candidates for holiness.

face à l'imprévu (Dealing with Unforeseen Situations in Flight), states that "If the unforeseen were the norm, crew training should be fundamentally oriented to deal with it, particularly stimulating pilots' capacities for judgment and creativity, essential qualities for this purpose" (AAE 2013, p.39). The skills required for creative risk management in everyday life and in extreme situations include mental flexibility, openness, associative thinking and selective combination, tolerance for ambiguity and a willingness to take risks. It is, therefore, necessary to develop a broad repertoire of scenarios to be presented randomly, including unexpected situations with contradictions, impasses or information that is usually not very connected. Imagining new scenarios could be facilitated in a virtual environment.

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SECTION 6

Organizational Reliability

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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11

Scope and Limits of Extreme Situations for Highly Reliable Organizations: A Pragmatic Interpretation

11.1. Introduction

The notion of an extreme situation has undergone significant growth in recent years in the field of analysis of organizations and industrial risk management. Beyond the obvious contributions of this notion, this chapter draws on John Dewey's pragmatic philosophy to question the empirical and theoretical limits of extreme situations. It then aims to specify some conditions under which the use of the concept seems to be most successful for organizational sciences in general and for high reliability organizations (HROs), in particular.

11.2. The growing interest in extreme situations

A recent study (Hallgren *et al*. 2018) shows that managerial literature is increasingly showing interest in the "extreme" nature of situations and different contexts in which organizations operate. Extremity is addressed here under its most radical aspect insofar: the "life or death" issue for the organization, as well as for the actors involved in the situation. The number of articles published on this topic in international scientific journals has increased dramatically over the past 30 years: from 16 articles in the 1980–1989 to 60 articles during 2000–2009.

These studies give "extremity" the status of an explanatory factor of performance, good or bad, of the organizations considered. Extreme situations are

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defined (Bouty *et al.* 2012) by their evolutionary (or even disruptive), radically uncertain and highly risky nature. The research program carried out by Lièvre since the 2000s on the management of extreme situations notes that "management situations" (Girin 1990) are becoming more and more "extreme" in nature, and proposes to consider "extreme situations" as a specific category of management situations.

The study of extreme situations is justified both empirically, in terms of helping organizations deal with this increasingly frequent phenomenon, and theoretically, in terms of entering into issues that are not usually addressed within the usual framework of organizational theories. Extreme situations dramatically reveal certain characteristics of organizations that remain less visible (or even invisible) in normal management situations. These include the process of expanding knowledge (Hare 2016) related to the preparation and conduct of expeditions in extreme environments (polar expeditions, Everest), the role of objects (the rifle) in leadership (Hare 2014) or the violence of events and relationships between actors (Guanieri 2018) revealed by the extreme situation created by the Fukushima disaster.

However, should extreme situations be distinguished from other situations? We propose to answer this question by mobilizing two theoretical currents. The first is pragmatism, which returns to the concept of situation; the second is the theory of HROs, which analyzes how organizations operate in extreme environments. This double theoretical detour will allow us to question the relationships between "situations" and "organizations" pushed to the extreme.

11.3. The pragmatist approach to situations

The concept of a situation is rooted in Goffman's interactionist sociology, which largely influenced Girin's (1990) concept of a management situation. The latter emphasizes the subjectivity of the actors expected to carry out a collective action subject to external judgment. But the situation concept is also rooted in pragmatist philosophy and in particular in Dewey's work (Journé and Raulet-Croset, 2008). A situation is then defined as an "indetermined whole". This means that the situation has no *a priori* limits: its development potential is infinite; in all its dimensions, in terms of the number and variety of actors, places, objects and temporalities involved. The limits of the situation are gradually drawn by the process of inquiry that actors trigger when they are confronted with the "problematic" nature of the situation, i.e. when something does not go as planned or desired and poses a problem in terms of action and understanding. The dynamics of the investigation (which is similar to a sensemaking process) then gradually transforms the indeterminate and problematic situation into a determined one, i.e. with a clearly formulated problem that can be solved. It is, therefore, in the investigation, through

the actions and reflection of the actors, that the boundaries of the situation are constructed and that the situation itself finds its definition. But this is never definitive: situations are ephemeral. It is also what gives situations their singular character: a situation will never be repeated in the same way.

Finally, the pragmatist approach leads us to consider that any situation can potentially be extreme. In other words, the extremity of a situation is present at the state of potential that is gradually updated during an investigation or more brutally under the effect of a sudden event. This leads us to consider that an extreme situations theory must think about the relationships between extremity and normality: all extreme situations arise in a normal situation and end in a normal situation. From the point of view of organizational sciences, not thinking about the articulation of extreme situations with normal situations runs the risk of limiting the scope of the concept and confining it to a category that is too narrow (or too broad...) and in any case too isolated from the rest of the organizations' life. However, it is necessary to take a closer look at organizations that regularly expose themselves to extreme situations in order to better discuss their specific nature.

11.4. HROs: keeping extreme situations under control

Designed to avoid accidents and deal with the worst situations, HROs and those they operate receive the mandate – more or less implicit – to maintain control of the situation, whatever the circumstances (Journé and Raulet-Croset, 2008). The literature review shows that HROs, operating in extreme risk and complexity contexts, are characterized by four main characteristics (Journé 2016): they are (1) reflexive organizations, (2) learning organizations, (3) paradoxical and (4) resilient organizations. Reflexivity consists of constantly questioning the relevance and effectiveness of current actions and decisions. It involves with each actor in the field the sensemaking processes (which are like constantly asking simple questions on the surface "what is going on?" and "what should be done?" and seeking answers) and "vigilance" toward others as well as towards developments in the situation as a whole (heedful interrelationships; Weick and Roberts 1993). The reflexivity of the actors creates the conditions for the emergence of a local self-organization able to adjust the organization's behavior in real time to unforeseen phenomena likely to affect its security and safety. Learning means that the organization uses past experiences, including errors and incidents, to change its organization and ways of doing things in order to improve its future functioning. We often talk about "feedback" processes. This type of learning is based on an organizational condition: transparency, i.e. the ability to discuss what is problematic without fear of hierarchical sanctions ("no blame culture"). In addition, the paradoxical or "dual" nature of HROs (Bourrier 1996; Journé 1999) is due to the fact that they are subject to very strong tensions and contradictions that cannot be eliminated, and must

therefore be managed by finding local and temporary balance points that promote security and safety. This includes the imperative of simultaneous centralization and decentralization (Perrow 1984). The management of these tensions places frontline actors and managers at the heart of reliability production (or degradation). These three characteristics of reflexivity, learning and paradoxical management lead the organization to be in constant production, reproduction and evolution (through the organizing processes; Weick 1979). Finally, the resilience of HROs lies in their ability to deal with all kinds of unforeseen situations that arise from the situations they encounter and that are likely to affect them (Weick and Sutcliff 2001).

The four characteristics of the HROs discussed above suggest that the question of the organization's relationship to normal and extreme situations needs to be explored.

11.5. The mutual influence of situations and organization: between normality and extremity

The two theoretical fields of pragmatism and HROs clearly indicate that "situations" and "organizations" influence each other. On the one hand, organizations seek to control situations, while the latter tend to escape them; on the other hand, situations weigh on organizations when they take the form of a brutal event and they even go so far as to produce organization through the inquiry process, which is similar to the process of organizing and organizational resilience.

If HROs regularly face extreme situations while maintaining a high level of security, it is, as paradoxical as it may seem, because they operate constant transactions between normality and the extreme situations they encounter or could encounter. There is a double movement of "normalization of extremity" and "extremism of normality". HROs "normalize" the extreme because they aim to transform it into manageable, and therefore standardized, situations. We can speak of a work of "de-extremination" of extreme situations. The challenge is to think in advance about the possible forms of extremity and to oppose it with technical and organizational devices likely to contain them. It is a question of locking these situations into appropriate rules and procedures. This is the case, for example, for "incidental" and "accidental" procedures. This reduces situations to standard forms that oppose the singularity of situations, such as the current of preparedness in the field of crisis management. Some authors (Borraz 2018) interpret crisis exercises as processes of normalizing the crisis, i.e. embedding the crisis in the organization's standard procedures and processes via the scenarios used in crisis exercises. Should we go so far as to propose the concept of "normally extreme" situations, by analogy with "normally disturbed" situations (Journé 1999)?

The phenomenon of normalization of extreme situations is mirrored in the process of extremizing normality: HROs assume that even the most banal situations have a potentially extreme dimension. Extremity is written in situations, it is latent, and this is the normal operating regime of the organization. The expected performances are themselves extreme, even though not all situations are covered by rules and procedures. HROs are not only able to handle contingencies that have been thought out in advance and covered by procedures, but also contingencies not foreseen by the organization. This refers to the strong form of resilience that is based on the processes of self-organization and vigilant attention mentioned above. In other words, resilient organization is not given once and for all, it is produced by actors as they grapple with the problematic situations they must maintain control of (Weick and Roberts 1993; Journé and Raulet-Crosert 2008). At its extreme, the situation creates a resilient organization. But this capacity develops in situations (investigation processes) that are not necessarily experienced as extreme, but rather as normally disrupted and whose potential extremity is explored by the actors (Journé 1999). Hence, the importance of thinking about extremity in relation to certain forms of normality, without isolating it from the rest of the organization's functioning. Moreover, some of Weick's (1993) work shows that the brutal extremity of certain situations can block sensemaking and investigation processes, and result in "cosmological episodes" that produce the collapse of the organization and lead to the feared accident.

But the normalization of extremity can also be a problem for HROs. The literature shows that this conception of extremity pushes the organization to its limits (Farjoun and Stabuck 2005) and lessens the reliability of HROs. This point echoes Miller's (1990) work on the paradox of Icarus: the search for extreme performance creates the conditions for failure.

11.6. Extremity traps and extreme situations

The main trap is to think of extremity, rather than situations or organizations. This is what emerges from the analysis by Hallgren *et al.* (2018): the authors refer to extreme "contexts" to refer to the diversity of terms and concepts associated with the adjective "extreme": extreme events, extreme environments, extreme organizations, extreme situations, etc. The question then arises: how can we not dilute the notion of an extreme situation?

Analyzing extremity rather than situations or organizations can result from a combination of several factors. First of all, the extreme situations studied in the literature often refer to "exotic" organizations because they are very specific and not well known to the general public. This can result in a description that is ultimately more "picturesque" than analytical of the shapes taken by the end and pushes it to

the second level of organizational analysis. Second, if an extreme situation often results in a phenomenon of astonishment from actors, organizational researchers are also exposed to it. The emphasis is then placed on the emotional states of individuals, on the violence of facts and acts (Guarnieri *et al.* 2015), with a tendency toward heroism that sometimes goes so far as to pit individuals against the organization (Laroche 2016). We then leave the sphere of work well alone to enter the sphere of survival without always worrying about the articulation of the two. Extremity disconnects from normality and the rest.

11.7. Conditions for a contribution of extreme situations to the knowledge of situations and organizations

The risk would, therefore be to produce a theory of extreme situations that is not a theory of situations itself or, more generally, an extremity theory that is not an organizational theory.

A pragmatic and HRO interpretation of extremity leads us to identify methodological and theoretical conditions likely to avoid this risk.

From a methodological point of view, two types of entry into extreme situations are possible. The first is to isolate situations that are immediately seen as extreme. The second accesses extremity through normal situations that become extreme under the effect of organizational investigative processes associated with a sudden event or a progressive and unexpected drift from the initial situation. The progression in situational awareness nowadays involves the search for complementarity between the two approaches, to better ensure that extremity is rooted in the concept of the situation and in organizational processes.

This point echoes the classic debates between HRO and accident theories. HROs have been chosen to analyze the normal functioning of high-risk organizations (Bourrier 1996) to avoid the biases introduced by accident analysis alone. Recent work in this area seeks to build bridges between these two approaches (Dechy *et al.* 2018).

The pragmatist approach pushes to consider extremity as a potential to be explored. It is a latent component of situations and organizations that emerges during reflective activities. It is the product of the organization at the same time as it produces the resilient organization.

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12

Error in Decision-Making Processes in Operational Situations: The Case of Fire Rescue Organizations

12.1. Introduction

In highly reliable organizations, decision making is a resilience factor for conducting business in unique contexts. The atypical nature of extreme contexts does not always ensure that there are no errors in decision-making processes. In this chapter, we have examined the place of error in the decision-making process in extreme contexts. This perspective is even more interesting when we look at the so-called organizational error, which can be described as an error that is part of the organization's practices and considered the norm in all situations. Our questioning encompasses these two aspects and can be formalized as follows:

– Can error in decision-making represent an educated practice for situation learning?

– How can we learn from an error when it written into the organization's rules?

In order to provide answers to these various questions, this chapter presents a conceptual model for the analysis of error in operational decision making (Gautier 2015). This model built around three concepts: extreme contexts (Lièvre 2012; Godé *et al.* 2016), situation awareness (Endsley 1995) and reasoning error (Bronner 2007). This model makes it possible to better reflect the uniqueness of the decision-making processes in action within organizations in extreme contexts. Its analysis should

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allow the recognition of human errors in decision-making processes for the learning organizations. The case presented will concern the analysis of a rescue operation for fighting forest fires.

12.2. The study of ordinary situations in codified activities for decision making

The decision-making model presented in this chapter was developed in an article published in 2015 (Gautier 2015). This model built by interweaving three concepts composed of extreme contexts, situation awareness and reasoning error. We use the foundations here to explore the ordinary situations encountered by the fire and rescue services in France.

12.2.1. *Extreme and unique contexts of at-risk organizations*

The management situations of fire and rescue organizations are rooted in extreme contexts. These contexts defined as dynamic environments in which organizations must implement resilience mechanisms in order to carry out their activities. Extreme contexts are defined by the unexpected, scalability and risk (Lièvre 2012; Lièvre and Aubry 2010; Godé *et al.* 2016). They require organizations to be able to adapt to the situation through a detailed understanding of the issues and characteristics of their environment. Weick (1993) characterizes them in the sense of equivocity to refer to the complexity of their understanding and the implementation of adapted modes of action.

For Godé *et al*. (2016), these extreme contexts do not prevent collective performance or even organizational security when error management measures are developed (Marc and Amalberti 2002). In these contexts, action is about controlling the situation, not avoiding mistakes. This observation is even truer in a context of urgency in which the organization may find itself in a degraded mode. Mission security then becomes an essential objective of the activity. The collective is a major asset in giving meaning to the decisions taken and the actions carried out. Marc and Amalberti (2002) consider these group strategies to be natural and spontaneous in order to guarantee the security of the organization's functioning for accomplishing its missions. It is a mode of action for security management in organizations confronted with unique contexts. It is a form of organizational resilience for maintaining the ability to act in an extreme context. Within our thinking, context is a factor that influences decision making and stakeholder representations.

12.2.2. *Situation awareness theory to understand the cognitive process of actors*

The question of actors' perception is more specifically addressed with the concept of situation awareness (Endsley 1995). Endsley developed this theory in aeronautics by studying pilots to understand their cognitive information processing mechanisms (Stanton *et al.* 2001). The model is a cyclical process with the identification of the environment and the complexity of the task by an individual. This perception of the elements is made consistent with the resources at the individual's disposal to make a decision and react if the situation changes. The interest of this approach is defined by the determination of three levels of consciousness: (1) the perception of the elements that constitute the environment and its kinetics; (2) the understanding of the situation allowed by the data collected in the first level and formalized and (3) the projection of future actions by decision making. The second level corresponds to the assembly of the data collected at the first level to form an "image" of the environment and produce an understanding of its meaning. This level focuses on the ability of actors, both novices and experienced, to integrate a set of elements that allow them to understand the situation as a whole. Finally, the third level refers to the ability of actors to project their future actions into their environment in the very short term. The knowledge acquired by level 1 and formalized in level 2 allows decision making to achieve the objectives set. These three levels are part of a cyclical process for the permanent updating of information related to the environment and the difficulty of the task to be performed.

This model takes into account action performance. It is the cognitive ability of an individual to be able to collect and process the right information to carry out his or her activity. According to Endsley (1999), this model also promotes the identification of learning errors in the decision-making process. A taxonomy of error is expressed in the form of inabilities to perceive information, and/or processing and/or in the difficulty encountered by the individual to contemplate future actions. This is why we associate it with the concept of reasoning error (Bronner 2007).

12.2.3. *Reasoning error for a cognitive approach*

The reasoning error corresponds to a cognitive and procedural approach to the error itself. This conception of error is part of an individual learning perspective, because it considers error via two characteristics. First, there is the intensive nature of the error perceived as the origin of its appearance and described as a deviation with the intention of acting by its very reasoning. In other words, the actor does not make up for the error when it occurs because they do not perceive it or consider it in their reasoning. Then there is the extensive nature of the error, which most often

results in a failure in results. This characteristic is most often retained in analyses as a negative factor in describing an individual's activity. Taking into account only the consequences of error does not make it possible to consider it as a factor for progress and learning within organizations.

In our opinion, human error corresponds to a process determined by a phenomenon in intension and extension in order to take into account the global activity of decision making and its learning potential.

By its characteristics, the concept of reasoning error makes it possible to highlight organizational error. We define it as an error in the organization's practices as a rule, procedure or reference and considered the standard in all situations (Gautier 2015). The application of failing practices reveals an anomaly and/or dysfunction in the results expected and not envisaged by the actors who apply them. It is the identification of human error in its intensive and extensive form that allows us to identify whether or not it is an organizational error and to foster a learning dynamic within the organization.

The three concepts presented above contribute to the development of a model for analyzing error in decision making. This model contributes to the construction of meaning in an extreme context, insofar as it developed from several individual processes such as the influence of the context, the perception of the environment and the way in which information processed for the conduct of an action.

12.3. Action-research methodology for analyzing decision making in situations

Research methodology defined by the researcher's posture, the planning of their observation in the theater of operations, and the use of radio and telephone sound tapes from the recorders of the organization's decision making and command cells. The objective of the methodological research approach is to codify actors' activity by means of a multisite ethnographic posture. This methodological posture defined by a total immersion in the organization as an expert volunteer officer[1]. It is the posture of participating observation (Peretz 2004) in order to understand the functioning of the organization and its activity by being part of the community's workforce.

Then comes the ethnographic posture in the theater of operations that the expert volunteer rank expert allows for the practice of feedback. This posture refers to the

1 An expert volunteer officer for feedback experience is a function specialized in observation about organizing during fire and rescue operations.

technique of observing participation (Peretz 2004) to analyze the activity being carried out while being integrated into the operational system to exercise the feedback function. It makes it possible to intervene during the course of operations to collect hot data on situation management. This real-time collection time is planned for the observation phase in the theater of operations. Observation work begins with understanding the decision-maker's perception of risk at the time of recognition, in order to identify the issues and means necessary to manage the situation. Second, it is necessary to understand the decision-maker's representation of the situation and he/she communicate it (or not) to their subordinates (tactical situation). It is important to observe whether there are gaps between the objectives set by the decision-maker and the actions of subordinates. These gaps inform us about the differences in representations and communication failures within the collective.

A posteriori, cold data collection carried out using sound recorders to reconstruct the entire intervention through the identification of the decision-making process taken by the relief operations commander. These recorders are used in three decision-making cells. Firstly there is the mobile command post located in the theater of operations. Then there is the emergency operational center responsible for meeting the human and material needs of the territory based on information transmitted by the actors in the field. Finally, the zone operational center provides support to the territories by providing national resources (aircraft, extra-departmental or specific ground reinforcements). The use of these sound recorders makes it possible to trace the chronology of the entire intervention with great precision and to integrate the problems encountered by each decision-making cell. Access to these tools is restricted to agents on an aptitude list due to the confidentiality of conversations. We have access to soundtrack recorders, because we are volunteer firemen and women and our mission is to produce feedback on the operation. The data collected cannot be disseminated, as they stand and require a final exploitation step to be integrated into a feedback document.

This methodological practice corresponds to an ethnography of communication as defined by Hymes (1972) and developed via participant observation through field surveys. Applied to our case, this method makes it possible to analyze the information circuit of the decision-making process during control operations. The ethnography of communication characterized by an analysis that focuses on the social interactions and actors' practices. It is a technique based on the empirical dynamics of situations to analyze the spontaneous conversations of actors in their sociocultural context (Lindenfeld 1978). The pragmatic nature of this methodological approach, combined with the contextualization of situations, is particularly relevant for studying the decision-making process in action in high-risk organizations. For Hymes, the activity of communicating is "a process by which people send messages and transmit them to others using certain codes" (Delbreilh

2012). In the organization of emergency services, these codes correspond to a codified language for the operational activity of firefighters and inspired by the verbal codes used in the armed forces for radio communications.

12.4. The case of the organization of rescue operations in forest firefighting operations: the management of cross-border operations

The operational situation analyzed in this chapter is an operational forest firefighting mission that involved the use of land and air teams. This mission took place on French territory near a border area with a fellow European country. National and foreign rescue resources as reinforcements carried out the mission. It was a virulent fire known for its history. In the past, fires in the same area covered thousands of hectares and crossed the border causing significant damage to homes and the environment. The local population, were strongly affected by this event and feared reliving the same scenario. Rescue services faced many difficulties, as there was only one poor quality runway (very stony, winding and narrow) to access the start of the fire and stop it. Foreign land and air teams arrived at the same time as the first French land vehicles. The border was a few kilometers from where the fire started and foreign civil protection did not hesitate to intervene occasionally to provide support and avoid the spread of the fire toward the border. Its action was in line with the French doctrine of forest firefighting, which provides for a massive commitment of land and air resources when the fire is in the making (a few hectares burned). The French and foreign emergency services did not have the same way of working and coordinating, and they did not have the same equipment (tools, machines). The professional practices of relief actors differed according to culture and resources.

12.4.1. *Definition of the extreme context of the forest firefighting operation*

These first elements describe the context of the situation based on the characteristics set out above: the unexpected, scalability and risk. The unexpected was determined by the French firefighter's lack of knowledge of the place and time of the fire. Fire is an event whose origin is difficult to establish, because it can be dangerous, reckless (failure to comply with the rules in force in forest areas such as setting a campfire) or unlucky (a broken car that burns and sets fire to vegetation). Evolution manifests by the kinetics of fire. Unlike other natural phenomena, fire advances and forces the rescue organization redeploying itself to ensure the fighting action. We call it a three-dimensional organization in motion, because it consists of land and air resources. This situation requires the decision-maker to have a good perception of their environment and a good coordination of actions in the field. In

the specific case, we are presenting the cross-border aspect accentuated scalability by the presence of foreign civil protection that came to participate in the response actions. Finally, the risk represented by the danger to the populations and stakeholders who carry out the control mission. Firefighting requires excellent coordination of action to avoid the risk of accidents generated by interpretation, representation or communication problems (Weick 1993).

12.4.2. *Application of situation awareness theory to the identification of the decision-making process*

The application of the situation awareness theory represents the decision-making process of the relief operations commander. The operational problem of this fire linked to the simultaneous use of national and foreign air resources.

12.4.2.1. *Situation awareness of an ineffective organizational rule for air safety*

In terms of the French national territory, the air safety procedure consists of leaving only national resources[2] to work on a fire. Departmental air resources[3] must withdraw from the air intervention area when national resources are present. There is no control tower on a forest fire to regulate air activity; it is up to the pilots themselves to organize themselves. This rule therefore makes it possible to ensure the aviation safety of the parties involved. French pilots of water bomber are used to working with foreign pilots because they are regularly involved in European fires as reinforcements (Spain, Portugal, Greece and Italy). European air reinforcements are also sometimes deployed on French territory to help manage catastrophic fires (10,000 ha). This situation is, therefore, not unusual for stakeholders. These contextual elements inform us about the first level of SA (situation awareness) with the decision-maker's perception of the elements.

The second level of SA concerns the understanding of the situation and, in this case, the rules implemented. In the presence of foreign aircraft on French territory, the procedure consists of integrating these air resources into the to-ing and fro-ing of French aircraft. They then use the same radio frequency, 142.2 Mhz, to coordinate. However, on this fire, foreign aircraft had small capacity radios that could not exceed 136 MHz. This situation was complicated because there were not many national French aircraft and their rotations for water supply were long. Foreign air

2 National air resources are aircraft. There are three types used for firefighting missions in France: the Tracker S2F, the Canadair CL-415 and the Dash 8.

3 French departmental air resources are small aircraft used for monitoring fire departure and treat small fires. There is usually an observation aircraft and a water bomber helicopter.

resources were more numerous and their rotations rapid, because they were water-bombing helicopters that refueled in a quarry's body of water located next to the fire. However, their actions were insufficient to ensure effective extinguishing of the entire fire. The situation required the use of all aircraft, both French and foreign.

The relief operations commander decided to divide the aircraft into two separate parts of the fire. It thus applied a rule of the departmental operation order that provided for the mixing of French and foreign aircraft in the event of a cross-border fire. On the left side of the fire, he placed the Canadairs aircraft, because the steep slope required large quantities of drops in this area inaccessible to the machines. On the right-hand side, he continued to work with foreign helicopters to help land-based combat assets to continue the extinguishing of the fire. This phase corresponds to SA level 3 by selecting a choice for decision making.

The lack of communication between French and foreign aircraft crews did not allow them to coordinate. While the first actions went smoothly, the relief operation commander decision maker left out one detail when the aircraft went for refueling. The Canadairs went to the right of the fire to go to a lake while the foreign helicopters turned to the left to refuel in the quarry. In this configuration, the risk of collision was particularly high. By cutting the drop axis of French aircraft, a helicopter almost collided with a Canadian aircraft. This near accident resulted in the immediate departure of French aircraft due to a lack of air safety. This final phase of the SA characterizes the non-performance of the action.

12.4.2.2. *Analysis of the SA model for a non-performance of the action*

The decision-maker's situation awareness was determined by the need to keep a large number of aircraft working on the fire. As land access was limited, the fire was fierce, the night was near and the population very worried, the decision-maker had to try to stop the fire as quickly as possible with the help of aircraft. By keeping French and foreign aircraft working on the same fire, the decision-maker unknowingly violated aviation safety rules because the pilots did not have the opportunity to communicate with each other to coordinate. As the relief operation commander had no aeronautical knowledge, it did not consider the risk of collision by distributing aircraft on either side of the fire. In addition, it merely applied a departmental operating procedure that provided for the mixing of French and foreign air resources in a cross-border fire. This procedure took into account the problems of radio interoperability with the use of frequency of 123.10 Mhz. However, this was a military frequency used on national territory by the RCC (Rescue Coordination Center) based in Lyon Montverdun. This frequency made it possible to coordinate all the air resources used to search and rescue an aircraft. It was, therefore, not free to use and required prior authorization from the French Air Force for its use. Civil security pilots in this emergency situation could not use it, as the authorization

procedure required interministerial recourse. The crews continued their actions by not knowing their respective fire procedures since they could not communicate with each other. The performance of the action was not achieved, because the different crews were not able to work simultaneously and calmly in the same airspace without safety rules. The firefighter officer was not trained to perform the role of air traffic controller, as it was not his job. He was, therefore, unable to perceive the complexity of the task in making this decision. To understand the scope of the difficulties, the concept of reasoning error provides us with key elements.

12.5. Perception of error as a practice for learning

We can identify the formation of reasoning error in the decision-making process of the relief operation commander. The phenomenon of intension error is defined by the action to keep French and foreign aircraft in the same airspace. Its objective was to maximize the striking force on the fire in order to stop it. Its decision making based on a departmental procedure (summer operation order) allowed French and foreign air resources to be "mixed" on a cross-border fire. However, the non-operability of this procedure led to a high risk of collision, as it did not solve the problem of communication between crews.

The error in extension was induced by the lack of coordination, which in turn led to a high risk of collision for French and foreign aircraft that were unable to communicate. Aircraft operated without being aware of their activity and were constantly on the move, making it difficult for a firefighter not familiar with the aeronautics industry to manage their safety. This situation resulted in a near accident between French and foreign aircraft. There was no learning on the part of the decision-maker, because he was not able to perceive the gap between his practice defined by organizational rules (departmental operating order) and the real consequences of this rule, which ultimately proved inapplicable in operational conditions (non-compliance with air safety rules). The analysis of the decision-making process in an extreme context allows us to understand the event and the reasons for the dysfunction. In an emergency situation, misunderstanding between actors does not allow a good understanding of actions and generates a climate of tension that is not conducive to the successful pursuit of the mission.

The concept of reasoning error makes it possible to identify an organizational error at the root of the dysfunctions encountered in the theater of operations. The procedure of the departmental operation order is not valid for an operational use of French aircraft in a cross-border context for two reasons. The first is the interoperability of communication systems between aircraft. The radio frequency identified in the procedure was strictly for military use. The second reason expressed by the inapplicability of the departmental operating order to the use of national air

resources. These means are governed by a national operating order that sets out the conditions for their intervention in operation throughout France and abroad. These means are, therefore, not required to comply with the relief operation commander orders if the operational conditions do not meet their aviation safety constraints. In this situation, they had every right to reject the idea of maneuvering proposed by the firefighter with the geographical distribution of the aircraft working on the fire. In this situation, the lesson learned is the reference to the national order of operation when national air resources operate on the French territory even in a cross-border area. However, decision-making in risk and emergency situations is a complex process, and air resources management is one of several actions for the relief operation commander. The commander must also manage land resources and their difficulties, ensure their safety and control the proper execution of its actions in a dynamic environment determined by the spread of fire. The practice of feedback is necessary to understand all actions in an extreme context and thus to place the organization of relief efforts in a learning and resilient perspective.

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PART 3

Register of the Intelligibility of Extreme Management Situations

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SECTION 7

Meaning and Sensemaking

13

Going to Extreme Situations: What Meaning Should be Given to Such a Project?

13.1. Introduction

How can we give *meaning to* our companies, for example, those that push us to travel, to explore a space near or far through this or that form of expedition or even to leave for extreme adventures? If adventure is a legitimate temptation, its opposite, sedentariness, is no less so. Because habit positions it here in opposition with novelty; it also remains appealing, depending on the circumstances. What then can justify leaving rather than staying? What is the meaning of an expedition? Why should I leave? Toward what and what benefit? Admittedly, the use of the term *meaning* is plurivocal, hence its ambiguity, due in particular to its mandatory and all-purpose use. Nevertheless, one cannot avoid such use for those who undertake an adventure, because to repeat oneself or even to explain the meaning one attributes to the journey one undertakes, it is already for the traveler or adventurer to ensure that the rationalization that one formulates for oneself or for one's loved ones will generate perseverance in the pursuit of the said adventure, an essential pledge to achieve the objective set and thus avoid one or other form of renunciation or possible abandonment. Therefore, if we want to answer the initial question asked at the beginning of this book, let us first situate the journey, expedition or adventure as a deliberate activity based on one or other form of project, formulated or implicit. Let us question what enables the current success of the project, whether it is a travel project or a career project or a training project, a project that provides meaning for its author through one or the other, or even one of the five senses that may cross it

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and give personal and/or social legitimacy to the author as well as to his journey or adventure.

13.2. Why go on a journey or an expedition?

The journey, like any expedition, is this intentional departure from home to temporarily explore another space, another space that forces us to confront our desire to discover the exogenous, different and unusual with regard to the homogeneous that represents our own home. This journey therefore makes sense insofar as it leads us to experience the heterogeneous, whether we make it as an explorer, a hiker, a walker, a passenger or a pilgrim, in search of one or another form of otherness likely to feed a contrast or even a disruption with the routine familiarity of the home.

The journey – as an intentional exit from home in search of the more or less distant, the new, even the exceptional – is unusual that is revealed on the way to the traveler, as Bouvier (1963) states: "A journey does not require a motive. It does not take long to prove self-sufficiency. We think we're going to go on a journey, but soon after it's the journey that makes or breaks you. "If we interpret Bouvier's point, the meaning given to travel will be in a continuous metamorphosis between the pre-trip of the preparations anticipating it, the unfolding of the trip with its unexpected and the post-trip in what we retain of it."

Long before Ulysses, the journey or one more of his substitutes was known to our distant ancestors, when paradoxically they began to taste sedentary life. But it took on a completely different meaning in our societies from the mobility that is seen in postmodern societies that wanted to combine holidays and travel (Viard 2000): leaving on a trip has therefore become very easy, through the means of communication that have greatly contributed to making travel very frequent and safe and therefore very commonplace. This banality too often erases the questions surrounding meaning; however, when it comes to choosing a destination, the haunting question of "Why go there more than anywhere else?" As a result, we forget that the banality of leaving for times older than ours, but in a modernity that is quite close to ours was not obvious. On this subject, we remember what Blaise Pascal (1670) wrote in the midst of the 17th Century modernity and in contrast to it in his book *Pensées* (thoughts) about entertainment: "All the misfortune of men comes from one thing only, which is not knowing how to rest in a room. A man who has enough good to live, if he could stay at home with pleasure, would not leave to go to the sea or to the headquarters" (section 139). Pascal added a little further on (section 171): "The only thing that consoles us from our miseries is entertainment and yet it is the greatest of our miseries." For Pascal, therefore, if taking an initiative can have a meaning, it is deciding to remain at home following a sedentary life in our refuge to give all its importance to the familiarity of the present moment. On the

contrary, for our contemporaries, the meaning they give to their initiatives lies most of the time in the mobility they seek (Urry 2000) through a desire for a future different from the present moment, travel being one of these coveted mobilities.

13.3. The unavoidable concern of the quest for meaning

But what is *meaning, than to give meaning, to make sense and to convey meaning?* As a first approximation, we can understand the search for meaning according to two complementary definitions, such as the concern to inquire about the justifications we elaborate and which appear sufficient to us. On the one hand, to understand the world in which we live and, on the other hand, to confer a satisfactory rationality to the action we deploy in this world. We can thus consider this search for meaning by going beyond its trivialization into commonplace, such as "common sense" and "good sense". Such a search for meaning, beyond these common places, remains an essential element to give ourselves a discernible horizon (Barel 1987) and temporarily thwart the absurd, nonsensical, incomprehensible, inconsistency or even this new arrival of the present times, the reification (Honneth 2005), all of which besiege us with the risk of being the only ones to occupy the foreground of our lives. So if we want to give this search for meaning the scope it deserves, given the questioning it raises, which touches on key data such as those concerning this existential founding paradox that requires us to reconcile our desire to exist with our destiny marked by finiteness, we must grasp meaning in a way that is not affirmative but paradoxical. We will do so by assigning four characteristics to this search for meaning, which we will successively review, recognizing that it is singular, temporary, partial and plural:

– a search for meaning remains singular, specific to an individual, a group or a given community and, therefore, dependent on the history of this individual or this group, on their current situation, on the environments they frequent, which makes them develop forms of rationality to make their behavior understandable. As Boltansky and Thévenot (1991) already pointed out, these forms of rationality are justifications for what the individual or group aspires to or has already achieved; at the same time, they are keys to their understanding of the situations with which they find themselves in or they have found themselves confronted with; the choice of a journey or expedition thus raises a question of meaning since it cannot remain without justification, as a free act. But not all travelers on the same expedition place the same meaning on their journey;

– a search for meaning is fluctuating, temporary, therefore provisional, dependent on the events experienced, the hazards of an experience that is structured in its successes and failures, the current situation that challenges. Deleuze (1969) spoke about the search for meaning as an infinite regression that is nourished by an intrinsic relationship between meaning and nonsense. The fluctuating meaning does

not mean that it is not sustainable in some of its components, constituting as many characteristic markers of individual rationalities or cultural logics; the values favored by an individual or a group to reflect an action carried out deliberately are quite often a sustainable mode of expressing meaning for a given actor (Gorz 2003) but these values at the whim of such or such individual or social change can also suddenly become obsolete and replaced by others that engage new forms of rationality, which is clearly shown by Pestiau (1984);

– a search for meaning is destined to remain partial, even fragmented, if, as Valadier (2000) puts it, the world is forever elusive in its abyssal depth. This search for meaning is therefore destined to coexist with doubt, questioning the threat posed by these destabilizing prowlers that are the absurd and the nonsensical. Only a borderline situation, that of ideological bias, can eliminate these prowlers. But then by sweeping away all forms of uncertainty and questioning, the search for meaning being transformed into forced rationalization and then more or less artificially transforming the existential uncertainty linked to any engagement in an action into dogmatic certainty;

– a search for meaning, although a singular approach, is intended to be both plural, since the term *meaning* is so polysemous from its distant etymological origins. The semantic unity historically constituted around this term has for several centuries gathered three dominant meanings: first the relationship of self with the environment through the use of the five senses, then the meaning attributed to the words conveyed by language and finally the common sense of consensus about such a question or problem (Rey 1998). To acknowledge the polysemy of meaning is to join Mr. Weber's (1917) posture about the inevitable polytheism of values.

It is these four characteristics that we will take into account here as a prerequisite for grasping the question of meaning, which is intended to remain an open question, never finished, although unavoidable, providing only partial and provisional answers in order to think simultaneously, as we have already mentioned above, of two sets that constitute any lived experience, apart from the perception by everyone of the world in which they live, others except for the action they are taking in this world. Today, the project has become the necessary paradigm for thinking about the future of this action in its worldly environment. The action of organizing a journey, expedition or adventure will serve us well to encapsulate the meaning in its four attributes that we have just identified above.

13.4. The project approach that generates meaning

Half a century ago, the then triumphant modernity had recourse to progress to think about its future, the outline of the project serving as an adjuvant, sometimes existential through phenomenology (Sartre 1947), sometimes operative to supervise

technological development. But a change in the economic situation has become necessary and this modernity has had to give way to a new era, more confused, more uncertain, that of post-modernity, which in the last five decades has seen a new domination, that of economic, financial, environmental, employment or global warming crises, not to mention migratory crises. The outline of the crisis will then cohabit chaotically with that of progress now reduced mainly to its technological advances alone. As we have had the opportunity to highlight (Boutinet 2015), the solution of the project indifferently used by each of these two outlines will give the latter, through its multiple uses, a paradigmatic role in the way it feeds on the two sources of progress and crisis: a technological project that guides the pervasive progress of digital technologies, professional integration or reintegration project or support project that frames individual paths that are often uncertain.

This project paradigm thus currently constitutes a representative image of the postmodern times of the 1980s, in its contrasts of success and failure. It inherits this mixture of progress and crisis that materializes it in the form of Janus; what can be called the postmodern project has thus evolved in recent decades into an object of everyday consumption, used so much and more according to situations. The project is even in sectors where it was thought that it could not be used, because it was too dependent on constraints that were more decisive than the possibilities it was likely to offer. To illustrate this fashionable effect of the postmodern project in our daily lives, let us consider three typical sectors, among the most recent to have deployed the red carpet in front of the project devices, leading the author of a project to make a path among the possible futures they were likely to identify: a better future, that of progress or a less bad future, and that of an attempt to overcome the crisis. These three sectors relate to the landscape, treatment and the event. The landscape project mobilizes the new profession of landscape gardener who no longer takes this landscape as an environmental fact imposed with its constraints on the inhabitant but as a space to be built or rebuilt through one or another form of project to develop the geographical environment. As for the patient's therapeutic project, they see the chronic disease not as an unavoidable condition to be endured by the patient during the decades they still have to live, but as a possible future to be developed by the patient in collaboration with their therapist to make this disease liveable by one or the other form of therapeutic project. As for the event project, at the disposal of the newcomer's new profession in professional spaces that involve the event, the latter no longer apprehends the event as what happens and at their own expense, by surprise but what they wish to make happen in terms of the unforeseen and astonishment in a temporality of immediacy. This is the case for the project of an event-commemoration or the project of a celebratory event or the project of a spectacle to be organized.

Consequently, the success encountered in recent decades by the project paradigm, (which seems to guide a good number of practices) can be linked to the

observation that the anticipatory approach to a project is meant to convey meaning, a meaning that is constantly questioned in a postmodern context, whereas the regime of modernity, that of the *Trente Glorieuses*[1] for example, was more concerned with these two other figures of a more rational anticipation than the plan and the objective, which had become the forefront of the present, because of their mainly operational nature. The current use of the project within a sociotechnical environment that complains that it is too often dependent on a quest for efficiency at the expense of a search for meaning can therefore be explained: this project, which is less obsessed with planning efficiency, is spontaneously saturated with meaning in the risks it intentionally introduces between vagueness and determination.

It is, therefore, these different modalities of meaning present in a project that we will review later, but first, we must answer two questions. On the one hand, who are these stakeholders in search of meaning behind a project? On the other hand, does the use of the project today not lead to an abusive use, dependent on a trend and which leads to the naming of any initiative as a *project*: in particular with regard to expeditions in the context of the so-called extreme situations that are at the origin of this contribution, is it not inappropriate to want to use a project approach?

13.5. The meaning of a project for its stakeholders: author and actors

Up to now we have mentioned several times the terms “author” and “actors” as stakeholders in a project approach. It is, therefore, time to justify these specific jobs rather than using other equivalent terms such as agents, subjects, individuals or persons. We will do so by justifying the choice of these terms of author, always singular within a project, and always plural actors in a project. In addition the concepts are well-distinguished even if in certain situations, there may be a shift in meaning from one to the other (Boutinet 2010).

What constitutes, among other things, the particularity of a project is the fact that it is carried by a singular and well-identified author, surrounded by actors. In the human order, the author refers to an individual or collective body that recommends an original creative work. In their project, this author authenticates that they are at the origin of this creative work, which unifies in a single process two essential stages in any project, materialized by two successive stages: a time of elaboration or conception of the project and a time of realization, implementation of the latter, in continuous iterative process with each other, the *design* continuously referring to the *outline* to be implemented. Creation, singularity and iterative design-realization describe what constitutes the original work of an author within a project approach.

1 A 30-year period that followed the end of World War Two in France.

Whenever we mention the author, we are led to specify what kind of author it is: an individual author, carrying their own story and purpose they want to implement or a collective author, group, team, organizational collective gathered around the same ambition to make such and such an initiative happen? However, it is quite exceptional to have to deal with collective projects in the case of self-managed projects, because most of the time, project collectives are coordinated by a well-identified individual pilot who embodies the project approach and leads a project team or a project group. In any case, both composed of a few central actors, responsible for successfully carrying out the said project under the pilot's authority.

An individual author and collective author of a project each develop collaborations, coalitions or even in certain situations confrontations with a diversity of actors, more or less close or distant to the author. If the actors are close to the author, they will position themselves, as resource actors developing advisory functions; if they are further away, these actors may be perceived as indifferent playing on their capacity for inertia or as confronting actors developing their critical sense toward the author and their project. In borderline situations, conflicting actors who are likely to manifest themselves in the author's environment may be eager to develop counter-projects in certain contexts, that call into question the author's own legitimacy and project.

If we return to the latter author, the because of their commitment to the project they embody, they hold as an author an authority that is inherent to them, consisting of an inventive capacity for action that they justify through their project and in the light of their environment. This capacity for action, of which the author testifies, will exert a more or less decisive influence on this environment, but will always be subject to questioning, depending on the circumstances. This ability to create and act therefore allows the author to testify to their authority that they will assume by being accountable for what they undertake in front of others, i.e. faced with the diversity of surrounding actors and stakeholders. By this assumption, the author claims as part of their original work, which affects the development or realization of their project. Such an assumption represents the first level of responsibility, which is also called first person responsibility. This first level is inseparable from the second level: responsibility in the second person. This concerns the right of imputation that others, i.e. an actor inside or outside the project system, may exercise concerning the problematic nature of a particular initiative taken or its consequences (Genard 1999): the actor confronting and even more so the conflicting actor asks the author of the accounts to answer for what they have done in the context of their project. Thus, what defines the singularity of an author is, on the one hand, their capacity to create an unpublished work and, on the other hand, their capacity to answer for it through one or other form linked to the two variations of responsibility mentioned.

13.6. The uncertainties linked to the project when thinking about extreme situations

To answer the second question we have formulated above, it is necessary to clarify what is meant by an extreme situation: does it leave sufficient freedom for the author of the management project to design a project approach based on possibilities to be inventoried, in order to promote some of them? Does management in extreme situations, on the other hand, target decisive constraints to which the actor or author of a project must necessarily comply? To deliberate these two questions implies, with regard to a given situation, that an initial diagnosis must be made in order to distinguish between two contrasting variants of extreme situations – that of a rigid space containing mainly strong constraints (in particular security constraints) and that of a projective space organized, despite the constraints around opportunities to be inventoried. The situation diagnosis will have to distinguish between these two extreme situations:

– an insecure situation, made up of constraints that must be taken into account to neutralize uncertainties and risks. This neutralization requires compliance with measures imposed in advance to deal with the said constraints: this is the case for the exploration of a damaged nuclear site;

– a situation that requires a heavy investment, particularly psychological, to achieve a performance or take up a challenge or overcome a difficulty, at the cost of possibilities and opportunities to be taken into account, which is the case, for example, for the exploration of sea ice transformed by global warming.

If the first situation falls in one way or another within the scope of emergency management, only the second situation – in terms of the possibilities and opportunities it offers, despite existing constraints, in order to achieve a given objective – will be open to the exploration project in an extreme situation under certain conditions. It is, therefore, only in relation to this second situation that we will discuss the exploration project in extreme situation management, as a generator of meaning.

This exploration project, with the methodological approach it implies, could constitute the means to carry out the desired expedition by explaining the goal to be achieved and the means to be mobilized to achieve it, while at the same time evaluating the risks involved in managing them. Because the first extreme situation is made up of major risks that can directly affect actor safety, having very few possible choices to choose from, we exclude it from project management in extreme situations and, therefore, here from our purpose. This is because it is to be dealt with more in an emergency mode because of an intervention protocol imposed in advance by the competent security institutions in view of this type of exploration. This protocol is intended to respond to a programmatic logic of adaptation and

effectiveness, very different from a creative project logic, or even often opposed to it. Such a protocol imposed by emergency and its mechanisms therefore excludes a question of meaning be raised about it, which is replaced by a notion of feasibility. In this regard, as we have had the opportunity to highlight (Boutinet 2010), between urgency and project as means of action, there is an incompatibility between immediate and medium-term deadlines. When, moreover, the emergency situation refers to a causal logic, the project situation opens up to a heuristic logic. We will, therefore, leave aside the emergency situation, because it is out of our scope. This is more a case of us denying the project (Boutinet 2011) to focus solely on the situation project. The project approach in the management of an extreme situation is thus understood, but what meaning should it have?

13.7. What meaning should be given to the willingness to undertake the project?

For an author, to give meaning to what they want to initiate in one of their projects, whether it be travel, expedition, or management in an extreme situation in the sense we have given above, is, for them involves asking one of the five questions inherent to any author who in their project wishes to establish their legitimacy with regard to what they are undertaking. We will successively review these five meaningful questions below.

13.7.1. *Where can we go?*

The *meaning orientation* is that of an intention, formulated by its author, specifying the particular direction they wish to take, that of a desired place to reach or transform, that of a more or less near future to which they aspire to make happen. This horizon toward which they intend to move toward is always twofold: spatial and temporal. This is even if, depending on the circumstances, one of the two, (spatial or temporal) will be more valued in the eyes of the other; on this subject to define what a project is. Sartre (1960, pp. 127–128) evoked overcoming a situation by being life-oriented, as an affirmation of humanity through action, a fog that emerges on the horizon of intentions. A horizon that is too clear because it is too close, that of the hour that is coming, of the day that is coming, of a deadline that is close to being met, of a precise objective to be achieved, of a confined space to be inhabited, is a constraint that subjugates and inhibits, because of concerns that are too immediate and/or too determined, preventing the evocation of a world of possibilities. The necessity embodied by an immediate constraint evacuates any form of meaning that can only unfold in a creative void that distances itself from the surrounding horizon, one that opens up to perspectives that encourage people to choose a direction to take a destination to stop at. With regard to the creative void,

the architect Bofill (1989, p. 33), summarizing his professional career as a developer of spaces inhabited by the project approach, dropped this summary statement: "In the end, I have never been anything but a creator of a void." In this, he agreed with – the sociologist Jean Baudrillard (2000, p. 115), in discussion with the architect J. Nouvel, and specified that emptying the space was undoubtedly the prerequisite for any authentic act of creation.

Having a goal that directs you to a destination helps provide direction, a sense of direction to the action to be taken, which is essential for creating motivation. To motivate yourself to move, you need a place to go: the sense orientation, therefore, depends intimately on the spatial and/or temporal horizon that the explorer sets. Once this sense of direction has been clarified, it then implies that the author plans the path that will lead them to the point of horizon set by benchmarks, deadlines and objectives. These will be guidelines to guide the explorer, which can also be challenging. However, these markers, embedded in each other, are a guarantee of effectiveness, but are not in themselves meaningful. Only the terminal deadline with the horizon that contextualizes it can be.

People, who are losing their autonomy and are dependent on one or another form of vulnerability and therefore forced to live day to day with an extremely close spatial and temporal horizon, cannot assume the position of explorers in their current state. This is because they are too dependent on the momentary constraints imposed on them (Maillard 2011). It is then difficult for them to imagine a situation with an evocative void and a future full of perspectives, likely to set them in motion. Rather, they are dependent on a luring void, what Maldiney (2000) calls chaos; they therefore lose all possibility of giving meaning to their movements, if not from time to time the formulation of an idealized meaning that risks being confused with one or the other form of velleity.

13.7.2. *Why leave?*

The *sense of direction* is insufficient if it is not accompanied by the *sense of justification* that rationalizes the motivation to leave for a particular destination. This sense of justification is intended to be at the same time a sense/meaning in the verbalization that it makes of the reasons for the choice made to take this or that direction. While sense/orientation defines the "purpose", sense/meaning informs about "why". "The author's justification of their project and the actions they plan to take to make it a reality stabilizes the decisions to be taken or already taken by the author and the actions that will make it a reality. However, the reasons that the authors evoke are often vague and imprecise, too often implicit, because they are not very verbalized. They are, nevertheless, the ones that can become motivating, because the latter is based on the formulation of the reasons to act. Motives,

justifications and reasons fall within the same semantic field and constitute three neighboring entries, which will stabilize a project and the actions it initiates.

Motives and/or reasons are elaborate justifications that prevent the author from being drawn into the elaboration and realization of their project by causes resulting from uncontrolled impulses. Ricoeur (1990) considers them as the logical force that gives coherence to motivation, the latter expressing psychological strength. Thus, an action without motive is subject to any drift dictated by a cause produced by a subconscious or dominant unconscious that takes precedence over the conscious of the motive. The verbalization of the latter may always be subject to re-verbalization along the way, because any motive is sensitive in its explanation, to reasoning by recurrence, making it possible to go from one motive to another, from one less superficial, more fundamental to the first reason, i.e. the one considered as the most legitimate (Polin 1944). Also reformulating a motive to make it more congruent constitutes support and legitimacy for the author's motivation.

13.7.3. *What significant opportunities dictate the current situation?*

Another important facet of the motivation to act is the *sensory meaning*: what is significant for the author or actor now, in the environment in which they are found; what concerns them, leads them to question, surprises them, interests them particularly? What do they sense, from without and within, in other words, everything that surrounds this author or this actor in what they are currently experiencing?

The term meaning, in addition to being a direction and a sign, therefore also plays the role of awakening sensoriality, a role made possible by these sensors that are our sensory organs, when they are on the lookout for what happens in the environment. This awakening generates intentions, aims and questions on the part of the author-actor toward their surrounding world. From this point of view, there is never a project if there is not at the same time a problem via a question, a surprise caused by a situation that causes surprise; it is through this question that the situation, by posing a problem, makes sense: problem-setting and problem-solving are thus inseparable from the project[2]. Through the implementation of sensoriality, the author of their project places themself in a situation of experiencing their

2 While the word *problem* comes from the Greek *problema,* the formulation of *project* comes from Latin, *projectum*. Both *problema* and *projectum* have the same meaning of "throwing forward", from which the idea of project is derived, but a questioning-throw from Greek heritage (*problema*) and a projection-throw from Latin heritage (*projectum*): these are two contrasting ways of discussing the art of *throwing forward*.

surrounding space, a place, a moment, a situation through the many messages they receive, some of which will motivate them into action, shake them up. Hence the challenge that any project poses to its author: make oneself available to connect with the world and seize the opportunities for action that this world offers; opportunities of moment as well as opportunities of place, both of which emerge from only outlined or well-established opportunities, to use the distinction made by Jullien (2001).

13.7.4. *How does my current questioning resonate with my personal history?*

A sense of sensitivity is the legacy of an experience built up throughout the personal history of the author of the project. This story is regularly revisited by its author, often without their knowledge, during what they experience and discover in the situations in which they find themselves currently involved. This feedback on personal history is an opportunity to identify the areas of competence and involvement that the author can momentarily draw from their past experience in order to identify both the spaces of familiarity and the spaces of fragility within which they evolve. These are benchmarks that can reinforce the author's motivational dynamics.

By positioning their current project in relation to the major stages of their life course, successes and failures, the author gives it meaning by shedding light on the momentary choices they make, by a feeling of coherence, continuity or on the contrary disruption, or even atypicality as is often the case in our postmodern contexts borrowed from a mobility that opens onto new paths. Feelings of coherence, continuity, disruption, atypicality or other are then to be positioned by their author in light of past experience and the questions that structure it. In this way, this author will be able to understand or relativize what they are currently aiming to achieve and at the same time identify the strong points that can structure what they want to undertake. They will be able to anchor the motivation behind their project in a genealogical perspective, that of the continuation of the experiences already lived with their key elements but also limits, due to previous failures, to destabilizing events such as those of the "impossible" linked to old age. From the relationship that the author establishes between what they plan to do and what they have already done previously, a sense of ensitivity will allow them to grasp in order to assume a bond of familiarity or, on the contrary, a contrast between yesterday and today.

With regard to the use of experience, it is appropriate in a project approach to identify the ambiguities of any experience; already, the action undertaken by a project tests these ambiguities, which generate as many intended effects as unintended effects. Among these unintended effects, some are a form of serendipity

that appropriately reinforces the intended effects, others that can be described as perverse effects that are there to counter them. Whatever they are, these different effects will have to be questioned by the author and the actors around them so that they can determine the meaning to be given to them.

With regard to the experience itself, Bourdieu (1980) has clearly shown that it consists of two forms of habitus, i.e. two systems of durable dispositions resulting from the experience: the first, which could be described in the Thomist tradition as an active habitus, a structure generated by experience. The second can be described as a passive habitus, a structure on which Bourdieu has placed much more emphasis, comparable to reproduction. The first habitus makes it possible to develop, through learning and its pragmatic shaping, then its memorization, new skills to act, which can be assimilated to abilities, as discussed by Sen (1992). These abilities are dependent, for the author, on their ability to link situation opportunities and personal availability mentioned above. The second, the passive habitus, is dependent on habit in terms of routine and repetitive forms. It is such mechanical and paralyzing forms that always risk invading the field of experience. However, exploring one's personal history is always a risky operation in the sometimes difficult distinction between active and passive habitus. Only the former, which has kept a capacity for self-questioning, is able to awaken a question of meaning through critical gaze by keeping the author's sensitivity alert, when the latter allows themselves to be invaded, without question, by a routine security that depends on a principle of investment economics.

13.7.5. *Whom to carry out a project with?*

The project cannot be a solitary undertaking; sooner or later it is born from a meeting between its author and the *other, others,* sometimes actors supporting and sometimes actors confronting. This other or others then become significant persons for the author. On this subject, we can only agree with the point made by philosopher Jacques (1982) when he writes that the project was always, for itself, the part of the *other* that was recognized in its own enterprises, which brings the author out of their narcissistic isolation.

This fifth meaning given to the project, which summarizes the precedents and goes through them, is therefore this consideration of this *other*, initially a simple witness in the elaboration and implementation that the author of their project leads. Through the presence and questioning of the other, their points of agreement, but also the way in which they manifest their difference, the author discovers what it is like in the *sense of interaction*, the discrepancies they introduce. We must not forget that any project is intended to initiate an action that will be implemented when it is in progress. However, one of the characteristics that define any human action is its

interactional dimension: it never leaves its human environment indifferent, but generates by itself an interaction with another person that cannot remain insensitive to the author's project. This interaction is, therefore, to be taken into account by the latter, who inevitably works in a socialized environment. However, this interaction with others – by eliciting feedback from them with their facilitators or approvers, their encouragement and questioning, but also their critical aspects, even their forms of opposition – will bring meaning. This takes the form of a social bond to be woven on a basis of cooperation, even on a basis of opposition, to avoid the absurdity of situations made of social unbinding between author and actors, of endless conflict between them, or of a systematic exclusion of certain stakeholders from the project or of grand isolation of the author. These are all situations in which the project no longer provides an opportunity to structure the social bond, but on the contrary, a process of social disintegration. The project then loses its meaning; neurotic motives in their irrationality replace regulatory motives.

13.8. To start a project, the art of steering a boat

These five senses that we have identified as likely to characterize at a given moment a project approach, we can imagine how to articulate them together by using a metaphor: a suggestive one of a boat's sea trip with its crew and passengers, equipped with its five constituent parts to be able to set sail, if only because traveling, going on an expedition for extreme situations is always a form of embarkation toward an adventure, a large one that turns its back on the familiar (see Figure 13.1). The attraction shown by the author and the actors involved in this form of adventure can only be meaningful if coordination is established in one way or another between the sensory awakening organs integrated into the boat. This existing coordination will then be a guarantee to the boat that at the end of its crossing, it will arrive safely at port. So let us quickly look at these five organs found in any boat, each of which is meaningful. So let us look at the rudder, keel, mast, stern and deck in turn:

– the rudder steers the bow and provides the *sense of orientation*, which sets, maintains or changes course to reach a specific destination;

– the keel, by stabilizing the boat, is similar in its invisibility at sea in the *sense of justification*, guaranteeing in the event of a gust of wind the boat's balance, anchored in consistent provisions and motives;

– the mast with its sails takes the wind, even resists the wind, feels the weather, by its *sense of sensoriality*, gives relevant information for maintaining or changing course;

– the stern leaves behind a trace, that of the course already completed in linearly or in zigzags, giving an insight by its *sense of sensitivity of* the coherence or inconstancy of the course already completed;

– the deck, where crew members and even passengers meet, allows us to offer, through its *sense of interaction*, a relational space for exchanges and discussions in order to give full space to the circulation of information and suggestive forms of sociability that break the isolation of the actors present.

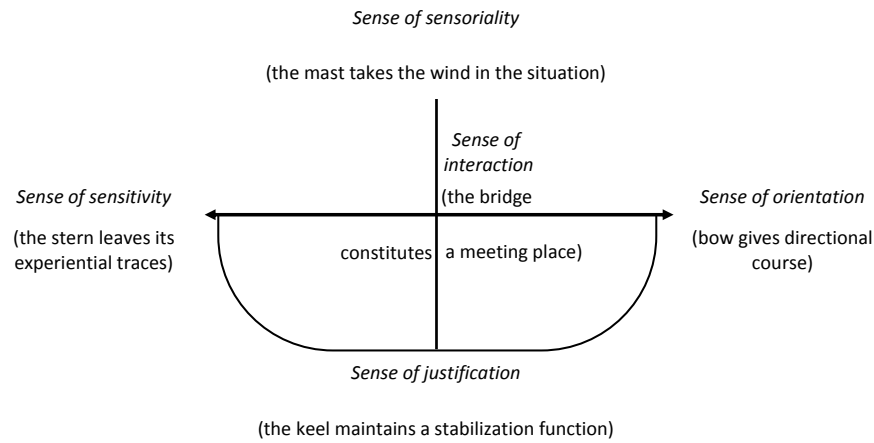

Figure 13.1. *The metaphor of the five senses that accompany a boat in a project*

Traveling, like managing extreme situations through a project approach, is an adventure, not a constraint but a chosen one. This adventure can be done alone by an individual author, but in any case, this author will not have been able to avoid encouraging the collaboration of actors upstream or downstream. However, it will benefit from being carried out within a collective approach with a captain, their crew and, if necessary, their passengers. This adventure will then have all the more chance of being significant for the protagonists who will participate or who have participated in it, as it will generate meaning in the way it was prepared, as well as in the way it is implemented during the crossing and subsequently in its mode of preservation in memory. It will be significant both for its captain, the author of the project and for the surrounding stakeholders involved in such an expedition. But according to the adventures considered, according to the author concerned and actors involved, the way in which the meanings conferred on the project are articulated will certainly speak differently. This adventure will, nevertheless, have an impact on the way the expedition is conducted and the memory that it will leave a decisive influence.

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14

Sense, Sensitivity and Competence

14.1. Introduction

The construction of sense by the actors in a situation is essential for the performance of a project in an extreme environment (Lièvre 2016). To address this question of sense rigorously, it is necessary to specify several points:

– we will discuss sense as it is expressed in actions, not in the sense of a text for example, as envisaged by linguists;

– the following analyses are the result of studies that required a long immersion to understand the human activity under study. The field of choice is volleyball, a highly normalized sport, which has been put in perspective with the field of polar expeditions, a freer practice in the open air;

– the converging results of these studies, conducted since the 1990s (Récopé 1997; Récopé *et al.* 2006), have led to the gradual adoption of a phenomenology of activity according to an updated, composite and radical inactive position (Récopé *et al.* 2014). This is based on recent extensions of the work of Varela, Canguilhem, Merleau-Ponty and Vergnaud in particular, and on our own assumptions on *"sensitivity to"* (Récopé *et al.* 2011);

– this position underlines the importance of the sensitive dimension of sense and the need to understand as much as possible the practical rationality of actors. Our approach is dispositional, i.e. it posits that the actors have incorporated tendencies or inclinations that play as a matrix leading them to feel, appreciate, perceive and act in a regular, relatively stable way, in a particular set of contexts (Bourdieu 1998, 2002);

– to fully understand sense, it must be distinguished and linked to meaning and information. It is necessary to break with "common sense". For us, sense is related to the activity, it is to be understood as the instance that gives the activity its direction or

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orientation; meaning corresponds to the way in which the world presents itself to the actor, it refers to the reality of the actor, i.e. to what is filled with a semantic content significant for them at the moment considered (the phenomenon, that which appears). The information is relational, it does not exist independently of the actor, it is not in the environment, nor is it to be confused with an instruction or indication that would be given to the actor from outside. Information is dependent on practical concerns, it corresponds to everything that, for the subject, constitutes an indicator likely to reduce the uncertainties that weigh on their action (thus to reduce the risks of failure) and reciprocally to increase the chances of success of their action;

– to make real progress on this issue, it will be essential to consider in the long term the processes (let us say "dialectical") that connect and build sense and meaning. Following the archaeology to find out "who was first the chicken or the egg?", it will be necessary to consider "was sense or meaning the first in the activity?" In other words, does sense determine all elementary meanings, or does meaning constitute a true emergence, that is, a radically new property arising from a configuration of elementary meanings? We are only warning here of the need to accomplish this dauntingly ambitious task that we will not address loosely.

14.2. Norms, actions and cognitive activity

Varela (1996) proposes enaction as an alternative to the still dominant cognitive sciences. The traditional criterion for evaluating cognitive activity is the more or less adequate representation of a predetermined external world, and for Varela, "the most important faculty of any living cognition is precisely, to a large extent, to ask the relevant questions that arise at each moment of our lives. They are not predefined but enacted, they are made to emerge from a background, and the criteria of relevance are dictated by our common sense, in a way that is always contextual" (p. 91). Ontology is relational, it postulates the original fact of the sensitive and primary connection of the individual to the world and the hypothesis of an interaction between the individual and the environment based on the history of the actions accomplished by a being (Varela *et al.* 1993). Recent extensions of enaction highlight the existence of activity norms: the agent is a center of perspective and activity that produces and maintains its own identity through its interactions. As a result, "only a small part of all dynamics in the environment enter as perturbations into the domain of relevance of the organism. All other possible interactions just fall outside of the possibilities of experience of the system. […] To have a world for an organism thus first and foremost means to have value which it brings forth by the very process of its identity" (Weber and Varela 2002, p. 118). Thus, the agent ensures for its benefit a normative modulation of environmental interactions, i.e. a normative regulation of interaction (Di Paolo 2005). This is in line with Canguilhem's philosophy of life and norms: to understand the living, it is necessary to study their pace of life, i.e. the concrete ways of life guided by embedded norms of activity that refer to a world of values (Canguilhem 1966;

Schwartz 2011). Norms of activity allow the organism to be thought of as a cohesive and projective unit acting according to certain typical practical arrangements, by virtue of its ability to orient itself positively or negatively toward certain objects (Visetti and Rosenthal 2006). These objects (which can be material, a person, an event, an ideal) are known to living beings by their value to them*:* "in any implicit or explicit form whatsoever, norms refer reality to values, express discriminations of qualities in accordance with the polar opposition of a positive and a negative" (Canguilhem 2007, p. 178). Norms therefore determine our sensitivity, that is, how we orient ourselves and interact with objects, events or people (Varela *et al.* 1993). Thus, every living person "responds to the demands of the outside world only according to the norms of [their] organism. The environment, as a whole of what the organism will be sensitive to, is therefore constituted by the organism, without, of course, this constitution being based on a faculty distinct from the acts by which living beings act within this environment" (Barbaras 2003, p. 143). This is why the enactive definition of cognition and survival focuses on their normative and pragmatic relational character. Actions concretize normative regulation, because these "interactions have a relevance for – and consequences on – the unitary identity [...] which is the source of informational, intentional or semantic values" (Varela 2010, p. 52). We cannot understand a living person's action without appealing to their own norms, because these alone make it possible to account for their privileged behaviors in similar situations (Canguilhem 1952). Varela (1989) similarly proposes the notion of "proper behavior" to designate such behaviors that have the following properties: they are part of an agent's observable overall state; they express the coherence and regularity of their operations; they are inseparable from their interaction history.

14.3. Meaning or sense?

These life styles or proper behaviors ensure, in and through the interactions they normalize, the process of sensemaking *(*Di Paolo and Thompson 2014), i.e. the permanent establishment of a meaning that is not only semantic, because it is inseparable from an adaptive value or from the positive or negative valence it takes for the actor[1]. This is consistent with Weick's (1995, 2001) sensemaking, which refers to what, in the order of an inquiry, ensures the personal meaning of information and situations.

The use of the term *sense* seems to us, here as elsewhere, ambiguous and confusing, since it actually refers to a *meaning* with value. But it reveals a spirit of the times that values the sphere of sense without rigor of use, instead of *meaning*; here are some examples of expressions accompanied by our comments:

1 This proposal is not new. To our knowledge, it was already found in Revault d'Allonnes' work in 1920, then Canguilhem's, Dewey's, Gibson's, Merleau-Ponty's, and Lazarus' work, among others.

– it makes sense; it is going in the right direction; it is significant: refers to a meaning/judgment that is positive (positive valence);

– it does not make sense; it is senseless; it is nonsense; refers to a meaning/judgment that is negative (negative valence);

– it is significant: refers to a meaning/judgment of appreciating something important, relevant, which refers to something else;

– give a sense to something (to one's action, to one's learning, etc.); it has sense: suggests that something did not initially have meaning (was empty) which is literally impossible;

– (evocation of) loss of sense: refers to a meaning/judgment deemed to be negative when linked to a perceived degradation (negative valence).

Let us come to a more problematic example: (someone) in search of sense refers to someone who is seeking their path, a satisfying self-realization, therefore someone seeking to satisfy their identity, which in reality translates into a suffering personal identity (see above).

These considerations lead to a distinction:

– valued meaning (always present in our reality, testifying to the existence of cognitive categories working by ensuring relationships of reference, difference, equivalence, inference, valence);

– and what is and makes sense (necessarily always at work in our activity, testifying to our identity, our norms, our own pace of life or behavior).

14.4. Proposal for "common sense"

Our inactive position considers that human activity is "object-oriented". It participates in the development of the heuristic framework initiated by Leontiev, aimed at reformulating or abandoning certain concepts and introducing new ones. It is about understanding the object that orients, structures and motivates the activity of individual subjects within a relationship of a passionate or desiring nature (Kaptelinin 2005).

Our proposal is the result of activity studies conducted from an ethnographic perspective and a phenomenological ethology (Thinès 1980) centered on the description and comparison of agents' actions evolving in a field of sociocultural practice (volleyball and polar expeditions in particular). The identification and comparison of three types of regularities (behavioral; circumstantial; based on feelings expressed in interviews) results in the conclusion that there are various populations of agents composed of members with similar behavior. The central

object, ensuring the global character of the activity ("a global description focuses all phenomena around a single center", (Foucault 1969, p. 19)), underlying the coherence and regularity of the acts of each population, has been identified.

For volleyball, 10 different populations (P1 to P10) have been identified according to the diversification *(Playing volleyball is above anything else...)* → specification of the central/global object of the activity:

– P1: *(... doing everything defensively to ensure that the ball does not fall to the ground on my half-court)* → the rally ending to one's advantage;

– P2: *(... performing the duties assigned to me well)* → roles within the team;

– P3: *(.... having a good time)* → a context for play and fun;

– P4: *(.... intervening when the ball passes in my vicinity)* → the proximity of the ball;

– P5: *(...not contributing to human relations of domination)* → rejection of the opposition;

– P6: *(... giving it my all if the game is worth it)* → the stakes of the game;

– P7: *(.... asserting my manliness)* → the impact of the ball;

– P8: *(... verifying the consideration X has for me)* → the look of a referent person;

– P9: *(... don't hurt me when playing the ball)* → pain when touching the ball;

– P10: *(...not being weak in the eyes of others)* → fear of ridicule.

It should be noted that most of these objects of activity, and the practical concerns they underlie, are at work among practitioners, but more or less depend on the population. Each population is characterized by the object that matters most and most often.

Box 14.1. *Sensitivities of volleyball players*

For polar expeditions, four different populations (P1 to P4), probably composed of subpopulations, were identified (Lièvre *et al.* 2003) according to the diversification *(Participating in a polar expedition is above anything else...)* → specification of the central/global object of the activity:

– P1: *(... feeling the pleasure of skiing and sliding)* → the feeling of sliding;

– P2: *(.... satisfying my passion through science)* → the study of the polar environment;

– P3: *(.... exploring and discovering the polar environment)* → the beauty of the site;

– P4: *(....achieving a sporting feat in the middle of nature)* → the speed of progress.

Box 14.2. *Sensitivities of polar shippers*

14.5. "Sensitivity to" and practical rationality

In accordance with our theoretical position, this central/global object of activity has been interpreted as an object of "*sensitivity to*", one that underlies, at the relevant moment in the agent's history, their identity and their sensitive rationality. This establishes a practical rationality, determined by a prevailing norm of identitary activity:

– an activity norm, because it is a value, or "everything alive is individualized by the values it updates" (Le Blanc 1998, p. 55) with three discriminating characteristics compared to the other values:

1) it is controversial, in that it contains both its antivalue and its opposite (Canguilhem 1966). Thus, the norm, "any preference of an order is most often implicitly accompanied by aversion to the reverse order possible. What is different from the preferable, in a given field, is not indifferent, but repels it, or more exactly is repelled"; in any implicit or explicit form whatsoever, norms relate reality to values, express discriminations of qualities in accordance with the polar opposition of a positive and a negative;

2) it is practical, in that it is expressed in actions, and not only in judgments of appreciation. "The norms set a framework for action" (Durrive 2010), it is operational: "norms have no reality outside the concrete action through which they are carried out" (Macherey 1998);

3) finally, it is mandatory, in that it is spontaneously imposed on the agent who incorporated it by requiring them to do what is necessary. According to Canguilhem, it imposes a requirement on an existence; it sets a use and determines a reference (1966). Thus, "values may only involve assessments, while norms imply imperatives" (Livet 2006). This property places them in the dispositions to act invoked by Bourdieu's (2002) dispositional theory of action. Interested in describing and understanding the immanent regularity and rationality of our practices without resorting to an intellectualist model or mechanistic interpretation, this author points out that we are literally possessed by these provisions: they push us, they determine us to act in accordance with them, they are stronger than us;

– there is prevalence because this particular value tends to usually (tendentially, regularly) impose itself as more important than the other values involved in/by the agent's activity within the sociocultural field of practice under consideration. It refers to what is vital/crucial for the individual in this field, i.e. what is most important to them *in situ* and for which they get carried away (mobilized). "Importance is essentially a subjective notion in the sense that it includes a reference to the life of the living being, considered capable of qualifying this same life according to what favors or hinders it" (Canguilhem 2007, p. 83).

By virtue of the prevailing norm of identitary activity through which it is expressed, "*sensitivity to*" is the sense of activity, sense conceived as the direction or orientation of the activity. It has a structuring status of practical rationality, as an overall orientation directing activity and experience and organizing them from the guiding value established by the prevailing norm. This orientation is a movement of consciousness that is realized, a direction of consciousness rather than the consciousness of a direction (Burloud 1938). It establishes the identity and perspective of the agent, their own coherence and their own world, and thus determines the conditions for their viability, their identitary satisfaction). *Sensitivity* constrains (opens and closes) the possibilities for action, meaning and learning within the field of practice under consideration; it constrains the field of the individual's normative interactions.

This proposal is partially in line with Leontiev's (1978) proposal for a "hierarchy of motives/reasons" (p. 123) that determines their relative importance to an individual. In the event of a conflict, the hierarchy of motives is responsible for updating the motive/reason that should prevail. According to Leontiev, the more important reasons, having a higher rank in the hierarchy, always determines the course of activities, which Kaptelinin critically questions (2005). Our observations confirm that the "always" is not verified, but that the prevailing norm directs and tends to direct practical rationality, as envisaged by the dispositional position. Two points highlighted by this approach escaped Leontiev. First, Bourdieu (1998) points out that having a disposition is only being inclined to act regularly in a particular way, in a particular circumstance. This does not imply that an provision is systematically updated; it cannot be used as a basis for any categorical forecast. Indeed, in appropriate circumstances, the agent may not act in accordance with the disposition assigned to them. Dispositions are relational properties that "have the strange property of tolerating counter-examples" (Bourdieu 1998, p. 60). Then, he underlines the generality that characterizes dispositions, insofar as they determine an infinite number of possible updates; they direct or orient the action, but do not ensure the complete programming of its course, this being subject to a contextualization dynamic (some would say that the course of action is situated). Contemporary models of action establish that its initiation, far from appearing to be a complete and deterministic representation of the totality of action, provides a framework requiring complements and updates that arise in the temporal flow of the action (Livet 1997). Berthoz (1997) confirms this dynamic, flexible and adaptable character, already underlined by Bernstein (1967) who stated that an invariant mode of organization of the action is not incompatible with a modulation of the conditions of its realization because of a need to consider the elements of variability in the context.

Thus, "*sensitivity to*" norms and initiates practical rationality, but does not determine the course of each action, which must be contextualized with reference to the circumstances that are relevant *in situ* from the agent's perspective.

14.6. "Sensitivity to" and structured activity

Sensitivity is the structuring sense of activity because it forces the recording of actions, decisions, behaviors and feelings in the practical rationality it organizes. These can thus be approached "in terms of vision, never in terms of division" (Canguilhem 2003, p. 14). They are therefore part of a structured organization, "as opposed to a simple combination of elements, a whole formed by solidarity phenomena, such that each one depends on the others and can only be what it is in and by its relationship with them" (Lalande 1991, p. 1032). It is the indivisible totality that realizes the relationship between the parts, so that apart from the whole, there are no parts (Canguilhem 2007).

Each population of volleyball players is interdependently characterized by:

– its relationship to the ball and its movements;

– the physical discomfort it consents to and the energy of moving to play the ball;

– its interactions with partners;

– the risks it feels during the game;

– the nature of the satisfaction felt;

– the terms and conditions of its interventions;

– the nature of the expectations it makes.

Box 14.3. *Examples of structured components of practical rationality by the "sensitivity to" demonstrated by volleyball players*

It can therefore be seen that *sensitivity* establishes a prevalent reference for the normative regulation of interactions and thus fixes a central/global object to be satisfied in multiple coordinated forms. It establishes a dynamic of mobilization by which behaviors selectively strive to achieve this satisfaction. Each population is mobilized according to what matters to it: the different personal resources (attention, information, energy, physical, biomechanical, affective) are available (i.e. at disposal) through synergy (i.e. by gathering and complementarity) and focus (i.e. by concentration and convergence). The different actions performed are all means to strive to meet the norm of identitary activity.

Each polar explorer population is interdependently characterized by:

– its preparation for the expedition, financial arrangements, the itinerary and the choice of equipment;

– its typical day and choices at the end of the daily stage;

– the risks felt, the pleasant circumstances and those that are painful.

For example, we can detail, for the four populations:

– the choice of the "right" tent:

- P1: do not overload yourself; the lightness of the tent is the main criterion;

- P2: it is the ease of assembly and use that counts;

- P3: to contribute to a pleasant stay, the tent must have good thermal qualities and comfort;

- P4: nothing must slow down the progression; the tent must be erected very quickly;

– the choice of the "right" weight of a loaded pulka sledge:

- P1: the maximum weight is 30 kg because beyond that you no longer feel the pleasure of sliding;

- P2: the weight must be equivalent to that of the explorer, or to what an ordinary human can pull without difficulty;

- P3: no maximum limit because the high weight level allows a long stay in the polar environment;

- P4: the weight limits the progression, so it should be reduced as much as possible and one must train beforehand to pull this weight;

– the choice of food strategy (Lièvre *et al.* 2018):

- P1: to fight against the weight carried, the itinerary is planned according to refuges to encourage large meals in the evening and light and caloric rations between stages;

- P2: a daily period that preserves habits; collective management of the meal or presence of a teammate known for his cooking skills;

- P3: the pleasure of eating well and a break at midday or when a site is admirable; 1 kg of food per day is planned to be eaten every day;

- P4: based on the agreed energy intensity: individualized lyophilized rations, high caloric efficiency and low weight.

Box 14.4. *Examples of structured components of practical rationality by the "sensitivity to" demonstrated by polar explorers*

14.7. "Sensitivity to" and competence

How can "sensitivity to" and the practical rationality it establishes contribute to effectiveness? It is the question of competence that is then convened. According to our position, any competence is a meaning of a positive appraisal. It is an assessment that values and promotes particular knowledge identified by a reference community. This know-how is considered to be held by a person or group when it is regularly and effectively applied in a myriad of situations.

The identification of skill can be more or less unequivocal. This leads us to highlight the difference between volleyball and polar expeditions:

– volleyball is an institutionalized social construct; it constitutes a specific sporting culture (Darbon 2002), a specific combination of behaviors and value systems determined by a formalized regulatory framework, of a normative nature. It constitutes a field of promoted actions (Reed and Bril 1996) that values a very specific global/central opposition relationship. Our analyses (Récopé and Fache 2010) established that this conflictual relationship concerns the rally-ending issue with the opposing collective, at the earliest, with regard to each attack. This relationship that underlies the opposition has the status of a sociocultural norm clearly specifying performance and essential competence and controlling the conditions of their evaluation. It is not surprising that members of the population sensitive to the breakdown of exchange for their benefit are the most efficient and competent (Récopé *et al.* forthcoming) because, having incorporated this norm, they are intensely mobilized to satisfy it. Their interactions allow them to be better placed, earlier, on more balls, and therefore they are more effective than other practitioners, all other things being equal, to play a flight ball in permanent air movement during the whole exchange;

– Polar expeditions[2] are organizational practices not subject to such unambiguous normative formalization. As a result, there is a plurality, even a conflicting diversity, of criteria for assessing performance and competence, as evidenced by the four *sensitivities* we have identified. There may therefore appear, even in situations, a serious disagreement on the nature of the competence(s) expected and appreciated among members of the same expedition (Récopé *et al.* 2010).

14.8. What about extreme situations according to this approach?

According to our position, there can be no extreme situation outside an actor's sensitivity. It occurs when an extremely important issue is at stake in the situation,

2 The plural is significant.

the actor being extremely mobilized to conquer this issue. It is the prevailing norm of identitary activity that appreciates a situation as extreme when the satisfaction of this issue (vital or crucial identity) is:

– out of reach or extremely threatened by a high probability of loss of great importance;

– secured or in the process of being secured by a significant gain when the probabilities of such a gain were low.

Thus, extreme situations depend on personal sensitivity and are situations with a strong identitary stake, unusual, risky, dynamic, whose outcome is uncertain. They are felt *in situ*, *in vivo*, *in actu* and *in tempo*.

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15

A Sea Kayaker's Identity Route and Learning Experience in the Arctic

15.1. Genesis

There is never a real beginning to a story – there is always a "once upon a time".

The first of my 11 trips to the Arctic was in July 2007. But where did the idea come from? Perhaps the idea Pascal Lièvre and Géraldine Rix had of an expedition with two sea kayaks. They formed a crew and then set out in search of a second. Maybe it came from that evening when Gilles Garel, invited to compose this second crew, told me about it. Perhaps it came from the morning after that evening when, on the way to my children's school, I made the decision to apply for this adventure, thinking particularly of a childhood friend and his own sea kayaking expeditions to Inuit land. Perhaps this trip was born from that dark moment when, 12 years before this school trip, I learned of the sudden death of a young friend.

Invited to question these 11 years of Arctic excursions, I turn to this question of origins with the feeling that it carries, within it lessons that I have not yet exhausted. But it is another question that will help me to look at this living material and extract something that could be useful, at least for me and perhaps for a hypothetical reader.

What did these 11 excursions bring me? What did I learn there, and what kind of person have I become?

The question is quite simple in fact, and I could fairly easily share these lessons with anyone who is interested in the question and who has a few spare hours. What is more difficult is to reproduce the tangle of answers in a written, short and linear

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Chapter written by Pascal CROSET.

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form. It is this last point, that of the linearity of rendering a complex thought, which is the biggest stumbling block. To get around it as much as possible, I will give the reader a panoramic view of these 11 excursions, specifying for each of them the main lessons I have learned as well as the connection with the following one. It may show a certain construction, a progression, a path...

I will then briefly come back to what the view of this inspires in me, this short summary of 11 years of excursion.

15.2. 2007: the initiation

Two weeks were spent in Spitsbergen, roaming and being autonomous, the sea kayak being the vehicle. To avoid repeating myself, I would like to point out that all excursions had in common that they were all conducted by sea kayak and solo.

It was an initiation trip, but above all a revelation of the fact that these living and discovery conditions carried within them and for me what Nietzsche calls the awakening of the "highest feelings". Much more than the satisfaction of a desire or want, it was an activity of full self-accomplishment.

Digesting this trip led a few months later to the decision to return, alone, the following year for a similar expedition. Why alone? Mainly to be able to anchor all the technical and logistical learning necessary for the realization of this kind of excursion. To acquire real autonomy, that of not depending on anyone to be able to design, organize and experience an expedition. Being fully responsible.

I naturally turned to the person in charge of my initiatory excursion, not to obtain her approval or opinion on my decision, but to gather the master's voice. She lived by her first teachings: being encouraging, being economical and focusing on the essential. "You're going to have so much to discover for yourself, and so many complex, engaging things, that my advice is not to increase this learning. The solution could be to repeat the same route".

15.3. 2008: the road to autonomy

I carried out these different technical and logistical training sessions, partly upstream during the preparation, and very largely on the spot.

But most of all, I discovered what loneliness brings. Rather than loneliness, let us talk about a solitary experience. It provokes and results in a self-knowledge that is absolutely unrelated to being with others. The reason for this seems to me to be quite simple, and it has to do with the notion of risk and ultimate responsibility for

oneself, with the realization that one is alone in making choices, and that one will have to assume their consequences without support and comfort. There is a Sarsat beacon and a satellite phone for security and warning purposes, but they do not guarantee timely rescue in all circumstances. Far from it... And I understood that quickly.

There was therefore this first level of vital risk to insure, to manage, alone. For example, there were multiple daily decisions: to leave or not to leave? Go to sea or wait? Where to set up camp?

It was not only the decisions that were processed in a solitary way, but also the management of emotions. The cold, the wind, the loss of temporal landmarks, the loss of social landmarks, the disorganization within the tent itself... So much for the somewhat rough emotions, but there is also the beauty of the world! What to do with the emotions provoked by so much majesty, by so much infinity, by so much beauty?

This way of being in the world, in full social naturalness and full responsibility, creates new conditions for the relationship between oneself and this world: new perspectives, new questions, new emotions.

Returning to more technical lessons, this second excursion led to the need to perfect sea kayaking skills. I experienced too many borderline situations, partly because they were poorly appreciated and badly anticipated. But since sudden weather changes were prevalent in these regions, anticipation and judgment cannot be the only guarantee of safety. If we want to encounter these spaces, we must, while remaining in the humility of fragility and lucidity of judgment, develop the ability to deal with the unexpected, especially at sea. That is why I decided to embark on a long learning path, leading to the development of a form of sea kayaking identity. I will never become one of these great specialists, but a decent kayaker at least.

Ten years later, I covered more than 4,000 km of kayaking in the Arctic, 2,500 solo. It ended up making a difference. Over time, kayaking has become much more than just a means of transportation. More than once, whether or not to complete a crossing properly depended on my partner's intimate knowledge, his behavior in the wave and in the wind.

This second excursion allowed me to develop a kind of "theory" that still guides me today as a fundamental reading grid: the theory of the "base and membrane". "The base as the minimum sum of the personal and essential attributes that ensure ontological and physical safety. The membrane as the external boundary that constitutes the validity limit of this base. To reach this limit is to be in contact with

this unknown person who can lead us to reveal much about ourselves. You don't have to go to the Arctic to do that, but I know that by going there, I will easily find that border, and that I will be able to continue to explore it in all kinds of ways...".

15.4. 2009: fraternity

Over the course of 2009, I therefore embarked on a sea kayaking training program. This leads me back to the trail of my deceased friend. Many years ago, he had followed a path of this nature, and I find traces of him where I too pass by. It was the confirmation, if necessary, that this trip to the Arctic was not a voyage, a simple expedition. It was indeed a journey of knowledge and self-improvement, through multiple encounters, confrontations and challenges. Here as in everything: what we find is equal to what we put in. What we receive is equal to what we give. If we are ready to commit, the return will be proportionate.

For the first time, I was going to go with someone less experienced than me: one of my two brothers. In other words, what we were going to test was simply our relationship. Knowledge would make us extremely considerate of each other. This would not prevent tensions, during deliberative moments. But we put them to work, this work of reflection and even of a very demanding reflexivity, leading everyone to question themselves very deeply, with regard to various situations experienced. The difference in experience and practice between the two of us did not completely solve the question of responsibility (for example by identifying the most experienced manager as the most responsible). As my brother says, everyone remains solely responsible for themselves. That is the basis for this. But a basis that itself does not exhaust the question. To this is added the question of what additional, or specific, responsibility this additional experience of mine entailed. The fact that everyone was responsible for himself does not exhaust this other essential question: that of the articulation between individual and collective responsibility. Because we were in a situation where what each one made as a choice and developed as an attitude had consequences for the other.

The path to take was communication. But necessity did not make it any easier. What changed with the daily life of the house were the consequences, the risks... They may have been a little stronger, but they were above all more immediate.

Our ability to forge this communication along the way allowed us to live an unforgettable experience, which nothing can alter. Over three weeks of our excursion, the beauty of Spitsbergen was on offer in the form of fjords, ice, glaciers, sun, fog and storms. Seals and walruses approached us, sometimes dangerously so. Bears left us alone... but the enchantment was permanent.

My companion ended up with a very tired body, but his heart was full of emotions that I know will be unforgettable. We talk about it regularly. For my part, I essentially learned that going with a third party means making this relationship the very heart of the excursion.

15.5. 2010: learning about limits, and the need for sharing

After three years of discovery and learning, the boundary, where the membrane is located, shifted, moved back. I was ready for a longer trip (five weeks), further away, more committed. I was also ready to learn about encountering a polar bear. The destination chosen left no doubt about it. The meeting had to take place. There was preparation, notably through meetings and exchanges with the greatest specialists (as is often the case, they are anonymous, and have developed a knowledge that they do not expose).

More than seven years after this experience of meeting the bear, I still have not found anyone to share it with, to discuss it with, except those who have also experienced it. And the reason is simple. Terrible but simple: the lack of listening, in the sense of welcoming without judgment. It is not a big surprise. Listening to the anecdote yes, but being interested in what is profound about it, what it raises as a question, no.

It does not matter. It is not like those people who have experienced a major trauma and whom no one can welcome and listen to, because their words are disturbing. My case is more commonplace, but what it raises needs to be addressed, and I realize that. Otherwise, the gap between others and me, between mine and me, will grow. The inability to share, in one way or another, this slightly offbeat experience of everyday life risks creating an increasing distance, forcing us to have a kind of double life, which I refuse to do.

Aware of the need to find a way to share, I will work to build it. And it is anything but obvious. A photo shoot on the way back is simply not to be allowed. It is just the opposite of what has to be done. The path is not simple, because it is necessary to find the answer to the following question: how can what I experience make sense for others? How does it connect me to others? I will therefore endeavor to answer this question, and then to find the moments when, and in what form, an exchange can take place. I think I have done pretty well at it.

One of the forms of sharing is to go with someone to take them into this environment and to bring them to experience comparable sensations on their own. This is what I did in 2010 when, after more than four weeks of solo excursion, I welcomed my wife for 10 days on a site that I considered totally safe. At least she gave me that trust... and as far as I know, without regretting it.

Outside of the week with my wife, the solo part of 2010 was very hard. A triple encounter with a polar bear resulted in the destruction of my kayak by this animal during my sleep. There were sea ice movements throughout Spitsbergen itself, which required a complete review of the route plan. There were also two occasions in which I found myself in icy water, one to recover a drifting kayak and the other due to capsizing.

The encounters with the bear were perfectly managed from my point of view, since neither he nor I had to suffer from it. As far as marine events are concerned, there is an error of assessment and judgment at their origin. These errors did not have serious consequences because of the preparation surrounding the excursion, which made it possible, in the situation, to remedy them without damage. I made a detailed debriefing of each problematic situation: factual description of what happened, analysis of the causes, analysis of the reasons that made it possible to manage the situation in the end without damage and finally lessons for the future. So much for the mainly technical learning, even if there are always strong cognitive dimensions behind it.

On a deeper, more generic level, bear encounters led to learning what I consider extraordinarily valuable. In two major registers, two registers that guide our daily lives, or at least mine: fear and listening. In the situation, I had to make leaps of understanding these notions, leaps of self-knowledge and practical work on oneself in relation to these notions. I have written them down permanently, on paper and in my mind... Nothing definitive, as these questions remain so open, but leaps that will ultimately help those who guide me on a daily basis.

Despite the very positive and enriching character of these multiple weaving skills, I aspired to continue my excursions, at least for a year, to a less hostile place. To put it simply, a place without the threat of a bear.

15.6. 2011: the discovery of a new territory

This excursion was to Greenland, three weeks, still in a sea kayak and again alone. The new frontier, the one where I would be able to touch my membrane, would be the discovery, alone, of a new territory, whereas the discovery of Spitsbergen had been made in the steps of initiation.

As always, “alone” means “with others”. It is necessary to find the support, upstream and on the spot, which would allow the excursion to continue, to bring the tools and the markers for a secure discovery.

In this new, extraordinary environment, around the largest glacier in the northern hemisphere, the first 10 days of solitude were particularly difficult, probably

because of the novelty of the place, the absence of landmarks, and yet the weather was rather favorable. The second part of the excursion, with harsh weather, was a delight. The solitary character was overcome, to access the magic of the place: encountering whales and giant icebergs, sailing at best on ice, meeting a shaman, meeting picturesque and unique characters, lives and life stories that mesh with this territory, and meeting with indigenous people, even if the language barrier is a real limitation.

Greenland, in contrast, helped to better understand Spitsbergen and its duality: an extreme natural environment, wild, but without indigenous life. A large nature reserve, whose primary characteristic is to be controlled, regulated by a (Norwegian) administration. On the other hand, Greenland is a land where people have lived for 4,000 years. They have a relationship with nature that is that of inhabitants, not temporary expatriates. There are few rules, a lot of individual responsibility and a lot of mutual aid, at least in the villages.

On a more technical level, this trip involved a change from a canvas kayak to a polyethylene kayak. Functionally, this allowed navigation in the middle of the ice, but it was above all a leap in the mastery of the practice. More demanding, because it was less stable, this type of kayak was also more maneuverable. This is an illustration of the paradox, or rather the complexity of risk management: there is a sea condition threshold at which a more stable, and therefore safer, kayak becomes less maneuverable, and therefore less safe.

This excursion was like an open door to a new world that remained to be discovered.

15.7. 2012: teaming up with a (nearly) unknown person

That year, I decided that I would not go alone. And this was the new frontier. I was going to leave with a person, a young woman, whom I met a few years ago in Spitsbergen. She had been traveling for a long time in a way quite similar to me, with a fellow excursionist who trained her but who did not want to leave again. His wife, who remained in the country, was seriously injured during one of his trips, and the fact that she could not be with him left a lasting impression on him.

Beyond the apparent proximity in the approach of our mutual excursions, everything separated us: character, lifestyle, etc. We spent many months exchanging emails to find out if it was possible, then reasonable, then possible to leave together. We eventually thought it was possible, and so we did it. We had gone a long way in explaining to each other what our usual practices were (average daily paddling time, criteria for choosing bivouac sites, feeding during the day, etc.), on the one hand,

and our intentions, on the other hand, regarding this possible excursion. Very explicitly we knew and we posed that the main challenge of this excursion was the functioning of our team. We chose South Greenland, a place neither of us knew about.

The excursion was extraordinary, both in terms of the route and the landscapes. It was very demanding from the point of view of this main challenge of working well together. We worked on it a lot. This did not prevent us from having a moment of quite high tension toward the end of the trip. But we were able to resolve it, once we calmed down. We then highlighted the fact that our communication, although very intense, did have its failures. By default of meta-communication: it was not only a question of communicating, but of knowing how to communicate. It is not always easy between people who know each other, so for two almost complete strangers... During this exchange, and while we still had a week left of excursion, we went far in terms of understanding how everyone functions, the revelation of these implicit elements that form an unspeakable and sometimes unconscious *grille de lecture*. This moment was, for me, the summit of this excursion.

At the end of the trip, each of us had contributed to the evolution of the other in terms of practices. I took from her the fact of spending more time outside the tent, for suppers, and cooking with wood (from roots in Greenland, because there are no trees). She took from me the idea of daring to go solo and sometimes setting up camp at a high altitude.

Like every year, I did much reading during the trip. These travel conditions profoundly transform one's way of thinking and reading. Among these were: *Une Vie* by Maupassant, which I did not like at all, and *Les frères Golovlev* by Saltykov-Shedrin, which I adored. These two books speak, among other things and in a very different way, about parent–child relationships. At the end of my trip, I had a kind of brain wave: I asked almost 20 years ago that the main criterion for measuring the success of my life would be the quality of the relationships I would have with my children once they were adults. I tell myself now that going away with them, at the dawn of their adulthood, can be a highlight of this father–son journey. And I think, after a long reflection, that the ideal age would be 17. My eldest son would be 17 the following year...

15.8. 2013: filiation (1)

Shortly after my return, at a family dinner where everyone was present, I turned to my eldest son, at the head of the table, and I said to him: "I will make you a proposal, and the only thing I ask you to do is not tell me no right away". Of all those gathered, he was the only one who understood, and he answered "no!".

Nevertheless, I developed my proposal, which also sounded like a promise: "I can give you secure access to an extraordinary environment, where you will be able to learn and make discoveries that are themselves out of the ordinary, but at your own pace, according to your own will. I will only be there to guarantee your safety in this space of discovery".

He eventually said "yes" two months later. His preparation was minimal. He was a great sportsman, but he knew almost nothing about kayaking, and the two outings we had at sea did not make a big difference, hence, we chose to start on a double kayak, and of course on a course that I have mastered. He was not going to take care of anything, not interested in anything about the trip up river. For him, it all started with stepping on Greenlandic soil. This was an illustration that this trip was not a request on his part, just a given agreement. He who already spoke little said almost nothing about the whole trip. The only choice he made was to have his own tent, and he quickly took care of setting it up in a place quite far from mine.

I worked very hard on myself throughout the stay to keep my promise. To have no intention for him, to let him live this adventure at his own pace, at his own hand, even if it meant getting up at noon!

The stay was deeply initiatory, and for both of us. And so, long before he turned 18, I considered him a young adult. As my sister-in-law had predicted, the stay was a setting that exacerbated what our relationship was like. It did not bring any surprise in this respect, but it nevertheless made it possible to make a change, a leap in our relationship. This son of mine will still do stupid things, things that a father will react to. But I see a great man, who has become in my eyes fully responsible for himself.

When the plane pulled us off the Greenlandic ground, my very modest eldest son said to me "thank you for the trip, it was good".

15.9. 2014: the parallel world

For the first time, I had visibility of the next two years. I knew that in two years, I would leave with my second son. So 2014 was for me, and I decided to go back alone.

I then measured the distance covered, the amount of learning achieved: course techniques, concerning the kayak or the overall management of the excursion. But also in my more general relationship with what can be called nature, risk management, the multiple emotions that arise from unusual situations.

I wish to explain how I got to this point, which makes me see the excursion as an entry into a parallel world, a world where almost everything is experienced and

thought and felt in a very different way, especially when you are alone. This thought of the parallel world comes directly from the level of mastery I have reached. I know how to go into this universe, feel at home, get to my frontier quickly and make all kinds of discoveries, about the world and myself.

I then decided to leave for more than a month (initially even two months, but I decided I would measure the negative impact on family balance), and to make a journey that could be described as very committed. From a logistical point of view, I learned an important lesson: how to send a kayak by freight.

I was going to start my stay with a week of carrying a ghost with me: because the route of the first few days followed the same route as the previous year with my son. Until I passed this point, I suffered very deeply from his absence. The phenomenon was both surprising and interesting.

After that moment, I encountered the beauty of the world as never before. I lived on water and land in a terrible storm. I reached a form of serenity at the very heart of this storm. I was connected with my own, living and dead, through thought and with an intensity never before reached.

I wrote a story of more than 50 pages about the situation. It allowed me to anchor the incredible sensations that crossed my mind every day.

15.10. 2015: filiation (2)

The year 2015 was the year of the trip with my second son. My two eldest sons are very different from each other, and their experiences were just as different. One thing in common, however, was the total lack of interest prior to the event and the virtual absence of preparation. He is also a great sportsman, and we only did three or four kayak trips during the year.

He later confessed to me that he felt he had no choice, and that refusing this invitation to travel would have been too hard for me. I maintain that he had room to say no, but that his conception of our relationship prevented him from doing so.

Nevertheless, he was much more talkative than his brother, and he made his mark on the excursion by developing a fishing activity. He had the chance to meet whales, even under our kayak. This trip was for him, in several respects, a trial: in terms of both cold and hygiene (it was not easy to wash). The stay was long (three weeks). He went through these trials with determination, with extreme concern for me and us. He grew up a lot, mobilizing his incredible reflexivity. Over the next few years, he echoed moments of this journey, what it brought him, the traces it left.

The most obvious impact, as was the case with his brother, concerned the nature of the relationships between us on the return, as a consequence of a reciprocal and partly interpersonal initiatory journey. This did not prevent significant tensions in the following year, but tensions between father and son, both adults. Something changed. Nothing radical, but substantial. The transition to another kind of relationship.

15.11. 2016: filiation (3) between adults

I had a strong feeling that the promise I made to my first two boys was kept: to offer them an extraordinary and safe space for their own discovery. I had confirmation when my eldest son came to ask me to go back with him! What better confirmation of a successful first trip?

When he asked, my surprise was great and my happiness was total! We went to a place I did not know (northwest Greenland), so we could be on the same level of discovery. And we went on two simple kayaks, which meant that his level of control and individual responsibility increased.

We had three extraordinary weeks, between two adults, in respect and fluidity of our relationship. This solitary person and mountain lover often set up his camp very high up, out of my sight. This sensitive man, open to nature, gave our journey the rhythm of the profound discovery of each moment, each place. And this in a space that I consider to be the most sumptuous of all the places I have visited in recent years.

Two days after our return, he left home to settle 700 km away, entering a beautiful agricultural school. The contrast was terrible for me, after these three weeks so close to each other. I only appreciate more the privilege it has been.

15.12. 2017: serenity and satisfaction

In two years, if he accepts, it will be the turn of my third and last son to leave with me. This therefore left 2017 free of any project. This led to a solo excursion. A long excursion, of more than a month on these lands that we had just discovered and which seemed to me to be incomparable. An omnipresence of ice, thousands of islands that make it possible to set up a form of roaming errance. No need to have a predetermined route. It is possible to be guided by your intuition. Only the approach of the return gradually reduces the scope of possibilities.

The guiding idea was to go north, very north. A road marked by a few villages. A long road, more than 700 km in the end. Because health could be found there. I

expected a deeply spiritual excursion, as I had the feeling that I was going to a parallel world whose codes I knew well enough to make a path of discovery in complete serenity. This was the case, beyond all expectations. Next to days of full sun and calm sea, I suffered storms, injuries, pain, weather that was sometimes very bad and difficult at sea, a lot of fog and intense navigational challenges. But I went through all this with almost total serenity. Including solitude, which at no time, even at the beginning, weighed on me. I took everything with me. I established a simple and powerful connection with space, place, sea, rocks and animals.

The main part of the preparation of this trip was physical: a year of almost daily training, alternating weight training and cycling. The other point was to be vigilant in keeping your mind clear. Not letting yourself be overwhelmed in your work by the many trips and the number of projects that have taken place throughout the year. Very concretely, this meant getting into bed automatically at 9 p.m. as soon as nervous fatigue began to appear. Discipline and rigor every day...

Despite this, I left with a mind very charged with all the professional concerns of the year, but nevertheless mentally clear and physically strong enough to be able to let everything evaporate over the first few kilometers. The very day of departure, the real start, that is, the day you put the kayak in the water, the day you leave the few others behind, I knew I was pushing a door behind which I had no idea what I would find. I found satisfaction, and access to answers without questions.

These answers were very enlightening, but they were also cumbersome, leaving me with a new question: what should I do now? Not next year, because it would be the end of a loop, the end of the trips with my sons. But what should we do after that? For the first time, there were no answers, because there was no certainty that it would be easy to reach the membrane. The answer will come, and I am not afraid. It may take the form of the end of this type of excursion.

15.13. Knowledge and self-improvement, more than an identity journey

At the origin of this journey, there is a call, an echo, a curiosity and an intuition. After the initiation, that is to say during and at the heart of this journey, there is extraordinary terrain for better self-knowledge. This terrain is made up of autonomy, commitment and responsibility in the face of the unknown and, from time to time, in the face of danger. This cocktail could work in many different places. The Arctic is my favored setting, a mirror of a taste I did not know, like the Parisian who belatedly discovers that Brittany is their chosen land.

The power of the cocktail can be measured through the following point. Over the past 11 years, I have had to spend more than seven or eight months in the Arctic. But all I have to do is close my eyes, concentrate for a moment, to get back to any of

the days I spent on an excursion, to know very precisely where I was and what I was doing there. This gives an idea of the emotional intensity, the concentration required by this way of life, and the strength with which it imprints itself. We then understand the reflexive capacity that it allows, or in which this can take place.

And the privileged place of this self-knowledge is for me this membrane frontier, where the basis ensuring ontological and physical security reaches its limits, where it is fragile. In this particular place, self-knowledge comes from discovery, from confronting the unknown, in a way that you have to learn how to grasp it.

Even if it is a little more than a means, self-knowledge is not an end in itself. Knowing yourself better is only one way to become better, to improve. And by that I mean simply trying to be a man among men, to be a bomme in this world. Hence it is absolutely necessary to find the way back to others, and especially to my own. To not let this path take me away from them, but on the contrary make it an anchor function. I reached this balance when I understood, or felt, that the forces that call me are equal to those that push me, and that those that bring me back are equal to those that send me back.

In this dynamic, there is therefore the reflexive work of self-knowledge, but there is also a vast learning function. Whatever your method of overcoming a hurdle, and especially once you've passed it, it is necessary to develop the capacities you lack in. Also, the reflexive animal cannot dissociate itself from the learning animal. There is the development of practices, and the development of knowledge, in extremely varied registers. There is an important point, which I have not mentioned here, which concerns the lives of indigenous people, confrontation with modernity, and confrontation with the contemporary colonial fact. Greenland and Denmark are discussed on this subject, but it interests me above all as a powerful mirror of the situation in France. A recent professional visit to Polynesia struck me in terms of the force of the parallels with the Arctic world.

In all the forms of study, reflection and especially learning reflexivity that I have developed, the place of the written word has always been essential. In the end, hundreds of pages were produced, mostly in real-life situations, but in forms as varied as the excursions themselves. The writing fits the event; it evolves over the years, along the paths.

15.14. Putting everything into perspective

To conclude this retro- and introspective rumination, I would like to put this focus on Arctic excursions in context. The very general context of a person who has

always been interested in DIY (I was nicknamed “MacGyver” by many of my friends), and who made ancient Greek culture an ideological cradle. The more specific context of 2007 when, in parallel with the opening of the polar front, I was engaged in a life as an independent consultant and a volunteer prison visitor. This last activity will be for me the counterpart and the obvious complement to the Arctic escapes. The other side of the same coin is the engaging relationship, with the unfathomable power of nature, on the one hand, and with humanity exposed by isolation and suffering, on the other hand. In both cases, there is the same search for truth, the same demand for responsibility, the same permanent work on oneself and the same openness toward the unknown and mystery, and similarly, the double sense of experiencing: feeling and testing. The same alternation of beauty and difficulty, the same path to the other or others, the same surpassing of oneself.

And at the heart of these two paths is the question of judgment: to investigate a situation, make choices, take options, engage, for oneself and others. To make a judgment, on the one hand, but also to learn to resist that of others, to the incomprehension of others. Being in the world also means suffering, facing or escaping, recognizing one’s ipsoeity and accepting marginality. To go to sea or staying onshore? To go alone or accompanied? To isolate yourself or to create a bond? To renounce being fully understood, to better understand and be partially welcomed…

15.15. Conclusion

My kayak master told me one day in front of about 20 people, with his arms around his son, who was to die a few weeks later, late in a long illness: “You are a quester. And you’re going to die, because your lucky star won’t protect you forever”. I think he was wrong on one point. But I understood it.

The story has no beginning. And as long as the mystery is there, I will not worry about its end.

SECTION 8

Organizational Ambidexterity

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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Organizational Ambidexterity: The Double Organic Ambidexterity

16.1. Summary

The field of project management has been considerably renewed over the past 20 years under the influence, in particular, of work on the emergence of the project (Williams 2005), temporalities (Boutinet 2012) and the need for the project to continuously reinvent itself (Midler 1995; Winter and Szczepanek 2008). In this renewal, the examination of extreme situations makes it possible to highlight alternating between planning and execution, between exploiting knowledge already acquired and exploring new knowledge (Aubry and Lièvre 2010). We already know that a crucial skill for an expedition leader is knowing how to recognize the need to change their mode of action.

This skill refers to the double ambidextrous nature of the project manager. We then speak of an organic ambidextrous environment that "lives" and adjusts continuously as the project progresses. Our interest is now focused on understanding organizational changes from the perspective of organic ambidexterity. How can this ambidextrous picture be found in the context of organizational change? Inspired by Van de Ven and Sun (2011), the focus here is on organization. This chapter aims to explore the dimensions of alternation in organizational change between the planned and the emerging, between what is known and what needs to be reinvented, taking the particular context of three major organizational changes.

The Cerisy conference highlighted the ambidextrous register at the heart of extreme situation management, the ability to mobilize and combine various modes of action throughout a project.

Chapter written by Monique AUBRY.

16.2. Double ambidexterity: an essential skill of the project manager

Research in extreme situations, including polar expeditions, has developed an understanding of "ordinary" organizations that would not otherwise have been possible. Moreover, the extensive literature review conducted by Hällgren *et al*. (2018) clearly shows the contributions of this literature to management studies and, more generally, organizations.

It is on the basis of a rather detailed analysis of the progress of the two polar expeditions that Aubry and Lièvre (2010) have highlighted double ambidexterity as the competence of the project manager. This double ambidexterity is defined in two dimensions:

– follow the plan or develop a new plan (after Mintzberg, 2004);

– research and learn (exploration) or reproduce what is already known (exploitation) (after March, 1991).

These two dimensions suggest different modes of action that can be combined without predetermined patterns. They use the judgment and subjective perception of actors (Van de Ven and Sun 2011).

16.3. From polar expedition to organizational change

Several researchers have examined organizational changes from a variety of perspectives (see, for example, Van de Ven and Poole (1995) for a literature review). What is of interest here for us here is not so much the reasons that lead to organizational change, or the processes to bring about such change, but rather to understand the dynamics of a change project through the practices observed during the course of such a project. The starting point is that an organizational change is a project and that this project follows its own trajectory from conception to final completion.

We propose to follow the trajectory of three organizational transformation projects over a 7-year period. The particularity of these projects is that they are of the same nature and take place in the same geographical area. These are organizational transformation projects in three Quebec university hospitals. Each of the transformation projects supports the human aspects of more global projects that include major construction and information technology investments. Human aspects mainly include the consolidation of clinical teams and the review of clinical, administrative and logistical processes.

At first glance, there is nothing extreme about a hospital setting. But here are several voices rising in a context of organizational change where the extreme

coexists with the everyday (Mintzberg 2017) as shown in this article from a daily newspaper, dealing with the latest reform of the health system in Quebec:

> "You [Prime Minister] know well those who work in our system and who have never given up, convinced that the collective efforts they were associated with would take precedence over the shortcomings of the system. You must take into account the situation of these thousands of workers who are no longer able to react because they are so disoriented, speechless, whose daily lives are disrupted and whose expertise is ignored in favor of rigid processes and methods that are directly derived from a financial paradigm" (Lamarche *et al.* 2016).

As in the polar expedition projects, several unexpected events marked the progress of these three projects. In this chapter, we focus in particular on the work of Van de Ven and Poole (1995, 2005) and more recently that of Van de Ven and Sun (2011). The latter article highlights the major organizational change issues inherent in each of the four change models. The authors cited above propose possible solutions to these problems. But the authors' proposal goes much further: it is not only a matter of correcting the situation in one model or another, but also of changing models if necessary: "Our proposals above focus on the action or problem-solving strategy of correcting the people or processes in the organization that prevent the change model from running as expected" (Van de Ven and Sun 2011, pp. 65–66). The current organizational context is often complex or pluralistic (Denis *et al.* 2007). These change projects take place over periods of time that are often long. It is therefore not surprising that organizational changes require a change of mode.

What Van de Ven and Sun (2011) suggest is to adopt a reflective attitude to evaluate a change in model. Of course, the authors warn against an unjustified change. A change of mode should only occur after attempting to correct the problems. The authors propose a temporal approach based on the relationships between the models. For example, we would move from the teleological model at the emergence phase of the project, then to the dialectical model at the development phase, and finally the models of the life cycle and evolution can better correspond to the implementation and dissemination phase.

We note that a change of mode is often necessary for the success of a transformation project. It is a matter of the project manager recognizing when to adopt a problem-solving approach and recognizing its limitations in order to change the mode. This is what we called above *organic ambidexterity*.

In the following, we show the relevance of this concept of organizational ambidexterity to better reflect the progress of the three organizational transformation projects, after a brief description.

16.4. Methodological aspects

The research strategy was qualitative in approach and based on three case studies. This was a longitudinal study that covered a 7-year period. The main source of data was semidirected interviews that took place at different times. Documents were also consulted for retrospective data. Table 16.1 presents the profile of the respondents.

		Case A	Case B	Case C	Total
Employment level	Respondents	24	25	15	*64*
	Expert	9	9	8	*26*
	Middle manager	4	7	2	*13*
	Director	6	9	2	*17*
	Project manager	5	–	3	*8*

Table 16.1. *Respondent profile*

16.5. Identifying mode changes: transitions

In Quebec, three major projects to build new hospitals have taken place in recent years. This situation offers the opportunity to study three almost parallel stories of similar projects. These projects can be qualified as major projects because they involved a total amount of nearly 10 billion Canadian dollars. We were interested in the human changes that result from these new constructions. Table 16.2 presents the general trajectory of the transformation projects in the three cases, named A, B, and C to preserve their anonymity. Case A is the most advanced case covering the entire period from the beginning of the project to the move. Cases B and C were ongoing at the time of data collection. It can also be added that there was a good camaraderie between the three project directors: several practices were passed from one organization to another.

Although the transformation projects took place at the same time and in the same city, each of the three cases has a unique history.

	Preparation			Realization		
	Controlling of the project	Duration	GO	First period: initiation	Second period: cruising speed	Third period: final sprint
Case A	International visits	1 Year	2008	Organizational turmoil	Extreme control	Success
Case B	Determining the site: conflicts	Very short	2011	Organizational turmoil	Organizational turmoil	In progress
Case C	Informal preparation	1 Year	2012	Smooth transition	In progress	–

Table 16.2. *General trajectories of the three projects*

16.5.1. *Case A*

The preparation of the Case A project resulted in several exploration activities. In Quebec, this was the first project of this magnitude in the health sector. Similar projects have taken place elsewhere in the world, particularly in Europe and the United States. It was these visits that made senior managers aware of the need to take charge of the human aspects of organizational transformation, which is often neglected in construction projects. Everything here had to be invented. The team's guiding principle was to make decisions based on evidence. This approach became a strategy for engaging stakeholders in decision making. A project office was set up as well as a coordination committee to ensure the follow-up and coordination of all individual projects. Project management is considered a key competency for successful organizational transformation.

While implementation was well underway, a serious ethical issue arose that involved a member of senior management. Everything changed after this event. The government implemented excessively rigorous budget monitoring processes to ensure that the project ran smoothly. After the shock of this major incident and the subsequent period of rationalization, the project office reorganized to continue the work already started. The control aspects of project management were implemented. Then, we implemented an approach that works, and reached a cruising speed. From there we can reproduce this approach from project to project.

16.5.2. *Case B*

Case B was the second to start. Several changes in the senior management of this organization disrupted the progress of the organizational transformation project. For long periods of time, the climate was one of uncertainty. The project was launched in times of controversy over the site of the new hospital, following a change of political party in government. It was therefore quite rapidly that the project organization was set up with a project office and a coordination committee. In this case, the focus was on change management, not project management. During the project, there were several stages of resilience and rationalization. In response, frequent adaptations of the project's organizational structure took place, for example, changes in the functioning of the project office.

16.5.3. *Case C*

Unlike the other two cases, the context of this project may be characterized by continuity. There was a change in the general direction, but the transition was very

smooth. The preparation phase involved exploring different approaches to project implementation that resulted in the integration of change management, project management and process management for each of the individual projects. A project office and a coordinating committee were also established. Communication was a strong point of this case, used to mobilize all stakeholders. During the project, the team gave itself time to reflect on what works and what does not. Once the cruising speed was reached, individual projects could be carried out by reproducing the methods of completing tasks.

Table 16.3 provides a summary view of mode changes throughout the project lifecycle.

16.6. Organic ambidexterity as a meta-competency

We have seen that each of the three projects has followed its own trajectory, which is associated with alternating modes of action. Like in polar expeditions, there is no predetermined sequence in the alternation. As Van de Ven and Sun (2011) assume, there is no temporal sequence based on the phases of the project's development.

This result calls into question the dogma of rationalization, which presupposes a linear and sequential sequence between planning and execution: one plans, and then carries out according to the said plan. Any discrepancy between reality and the plan must be addressed in such a way as to get the project back on track, i.e. back to what was planned, in a problem-solving approach. In the three cases studied here, it was found that organizational change is reviewed on an ongoing basis to take into account new situations, either tensions arising from the internal context or unforeseen events. It was observed that planning (the teleological mode) was reviewed throughout the project to address new situations. In short, there is a continuous alternation between planning and implementation. The plan is not a mandatory and unconditional procedure; the plan is a dynamic knowledge resource adapted to new situations. This result confirms what Aubry and Lièvre (2010) observed in the context of polar expeditions. We are here in a managerial context where extreme situations cross the "ordinary" in the realization of organizational transformation. The double ambidextrous nature of the proposed competence takes on its full meaning here in the managerial context.

It is therefore important for the project manager to be attentive to the progress of the change project in order to perceive if something is wrong. Does the current mode of action result in problems? This is where we refer to this competence to identify when to change the mode of action. This requires the project manager to perceive

that something is wrong, which is a prerequisite for organizational learning (Argyris 1993). Van de Ven and Sun (2011) go even further and suggest that the project manager has several mental models of change. Having several mental models of change allows one or the other to be used depending on the situation. In this sense, it is a meta-competency, one that encompasses and exceeds the specific competencies associated with the role of project leader or project manager.

By definition, the concept of ambidexterity is a good response to a nature of flexibility that is expressed in two different and exclusive moments or temporalities, one *or* the other. However, the concept of ambidexterity is sometimes a little narrow to reflect *pluralistic* phenomena encountered in organizations. These pluralist situations are not limited to two limits, i.e. one or the other, but rather put these limits under stress by calling on both. Ambidexterity and pluralism are concerned with phenomena where there is multiplicity in and around organizations (Comeau-Vallée *et al.* 2017). There are many ambidexterities as there are many pluralisms. But all require the ability to make sense of ambiguity and uncertainty. The notion of *paradoxes* (Smith and Lewis 2011) has been proposed to take into account the tensions that exist in organizations and that require, like ambidexterity, to make sense of these tensions. The paradox concept is opposed to the dialectic of ambidexterity, while sharing a certain kinship around contradictions (Hargrave and Van de Ven 2016). These authors propose a frame of reference that integrates these two concepts that share the sensemaking and distribution of power. They also suggest a research agenda on this topic. In this sense, research presented here on organic ambidexterity fits well in this stream of research on sensemaking and distribution of power (Hargrave and Van de Ven 2016).

16.7. Conclusion

Pluralistic organizations are characterized by their complexity, diffuse power and the diversity and divergence of stakeholder values and interests (Denis *et al.* 2011). In this sense, these organizations are in what could be described as extreme situations in the ordinary extreme register. The ordinary extreme here presents itself in a complex situation of organizational transformation. It identifies the characteristics of the extreme: an evolving situation, experienced as uncertain and risky. Carrying out an organizational transformation project in such a context requires attention to the project's progress in order to adapt the mode of action to changing situations.

As Aubry and Lièvre (2010) have already shown in polar expeditions, all the modes of action of double ambidexterity are present, and none takes precedence over the others. There is no predefined pattern of how the modes of action alternate. In other words, different situations lead to different patterns.

Also, the main question is when to change modes. As can be seen in the three cases presented above, mode changes occur at critical points in the project's lifetime, and not only during transitions in the different time phases of the project. For example, in Case A, it was a serious ethical problem that led to a rationalization of the situation and the adoption of a planning control approach that prevented the exploration and emergence of new approaches. In case C, we found ourselves in a situation where they were exploiting practices developed upstream and which gave good results, while demanding that the actors remained attentive to the context.

Interestingly, in all three cases, we identified practices related to organizational learning as suggested by Argyris (1993). For example, and particularly in case C, several opportunities for collective reflexivity took place during the project to take into account resistance or difficulties and then made it possible to adjust the modes of action. Reflexivity (Schön 1983) in turbulent situations allowed teams to adopt a resilient approach to overcome negative effects and continue their work in another mode of action.

The change in modes of action as seen in the three cases of organizational change leads to the identification of a meta-competence where reflexivity and capacity for action occur together. Individual skills may be mastered, but this is not enough to make informed decisions in a pluralistic context; organic ambidexterity requires these skills, but at the same time integrates and exceeds them.

This research also highlights the limits of ambidexterity to capture the pluralism that is present in extreme situations. This may lead to exploring the relationships between ambidexterity, pluralism and paradoxes in and around organizations (Hargrave and Van de Ven 2016; Comeau-Vallée *et al.* 2017).

In conclusion, starting from the idea of organic ambidexterity, this chapter has tried to show the interest of knowledge from extreme situations for studies on organizations and management. Here, we have focused on major organizational transformations that correspond well to extreme situations. The organic ambidextrous process has made it possible to highlight the changes in mode that are taking place in the trajectory of these changes.

16.8. Acknowledgments

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16.9. Appendix: changes in mode of action in all three cases

	Case A	Case B	Case C
Preparation	We learn what we don't know and plan widely – without knowing much about the nature of the projects. International travel organized for senior management: sharing of findings that need to be invested in change management. Highly focused on evidence. *EXPLORATION – EMERGENCE*	Even before the work begins, the transformation project is undergoing a major turnaround with the change of political party in government. There is little time to learn from previous experiences. We act quickly based on what we know. *OPERATION*	We learn through encounters and collaborations with a variety of research sources. More organizational innovation. *EXPLORATION – EMERGENCE*
GO transition: passage from preparation stage to realization stage	Appointment and organization: start with a participatory approach. Concern for stakeholder management. Development of terms of reference for the project office and the coordination committee. Development of a project management approach – hiring several employees who meet these profiles. *PLANNING – EMERGENCE*	A fairly minimalist approach to project management is being developed, but one that is more strongly oriented toward change management, which better matches the project office manager's profile. Once again, we are focusing here on what we know best. *PLANNING – OPERATION*	We develop a unique approach where projects – change – processes are closely integrated. There is a fervor from the project office team that seems to be spreading throughout the organization. This team regularly gives itself moments to reflect about what works and what does not. *EXPLORATION – REFLEXIVITY*
Realization	Serious ethical problem: transition to a period of control by the ministry. This problem associated with the behavior of an executive officer has nothing directly related to this transformation project. But from then	Significant changes in the management team have occurred successively, leading to periods of turbulence in the management of the transformation project. It was necessary to reinvent oneself according to the	Repeated success – we are in a rolling machine. Constant communication/ mobilization of the team *EXPLOITATION of the developed solution – Repeat what works*

	on, everything changes into tight control, making it impossible to have any room for maneuver. We develop metrics, all are aware of the rigor of project management. We provide training. *TERMINATION – RATIONALIZATION – ADAPTATION – PLANNING and CONTROL*	change of direction. *RESILIENCE – RATIONALIZATION – ADAPTATION – EXPLORATION*	
Performance – ready to move	Despite a period of significant turbulence and government control, the final sprint began with the determination to succeed. *PLANNING – OPERATION*		

Table 16.3. *Changes in mode of action in all three cases*

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17

Radical Change in an Extreme Context: Mountaineers Conquering the Darwin Cordillera in Patagonia

17.1 Introduction

The purpose of this chapter is to present the analysis of a specific episode of the Darwin mountaineering expedition in Patagonia. As part of a project by the *Agence Nationale de la Recherche* (French national research agency)[1], we conducted a longitudinal case study combined with an *in situ* and real-time ethnographic study of this expedition.

The study of the episode that is the subject of this chapter was carried out in close collaboration with linguists Caroline Mellet, Frédérique Sitri and Sarah de Vogüé, as well as Linda Rouleau and Gilda Simoni. In this extreme context of an expedition to one of the last unexplored territories on the planet, the analysis of this episode sheds light on the process of radical discussion and reconfiguration of the project and can help us understand why it is so difficult, even though the performance or survival of a team is at stake, to abandon its tools, plans, frameworks and implement a radical change.

The objective of the Darwin expedition was to carry out in six weeks the world-first crossing of a virtually unexplored mountain range, the Cordillera Darwin. This mountain range, about 150 km long, is located on the large island of

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1 ANR DARWIN project (ANR-09-BLAN-0341-01, www.projet-darwin.com).

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Tierra del Fuego, in the extreme south of Chilean Patagonia, near Cape Horn. This is an extremely hostile, risky and uncertain environment. There is no precise map or GPS data, glaciers are bristling with crevasses and were swept away by the violent storms of the furious fifties. The mountain range is only accessible by sea. A fishing boat, the Nueva Galicia, was used as a mobile base camp. The team consisted of 12 high mountain guides and mountaineers, the boat crew, a Chilean guide and the webmaster, as well as five researchers.

17.2. The episode of radical change

This episode took place on the 9th and 10th days of the expedition. During these two days, the mountaineers evaluated different options, designed and accepted a radical change in strategy, and effectively implemented it. According to the initial plan, the Nueva Galicia was to leave Punta Arenas and drop off the mountaineers 36 h later at the western end of the mountain range. The boat was then to sail on the Beagle Channel along the mountain range, thus ensuring its function as an itinerant base camp in conjunction with the progress of mountain climbers. According to the envisaged plan, mountaineers could therefore make round trips between the peaks of the mountain range and the Nueva Galicia to restock and pick up equipment, or in the event of a medical emergency. This last point was particularly important, given the team's total isolation in this extreme environment (no air rescue possible, high complexity of maritime access).

But given the fact that 8 of the 40 days devoted to the expedition had already passed at this point, the whole team was stuck 150 km from the planned departure point. Due to a succession of mechanical damages and violent storms, the Nueva Galicia had not managed to cross the straits of Magellan (the largest naval cemetery in the world) to reach the mountain range.

During the 9th and 10th days, the mountaineers discussed the different possible plans. Initially very reluctant to change the initial attack strategy ("we can't imagine the expedition without a boat"), they finally accepted the complete reconfiguration of the expedition and implemented it ("we'll leave the boat behind... Come on, we'll carry our own bags!"). So what happened during these two days? I was there, and I was able to attend the debates and discussions of the mountaineers. But the reasons why they finally accepted and implemented the radical change did not seem obvious to me. It made me want to know more ("the spark"!) and to examine in detail what had happened. We therefore studied the data collected in real time during these two days, and in particular the transcripts of the recorded conversations and the logbook.

On the 9th day, the mountaineers tried to interpret the situation: how much longer did the boat risk being blocked? What were the potential consequences for

the expedition? What information would help to clarify this? Where could they find it? If the boat was still stuck for several days, the whole expedition would be threatened: "If we are here for four days, we can at least try to think about that. Since, if we're here again for four or five days, it will definitely jeopardize the expedition. This calls it into question. So it is worth thinking about it, but you can only think about it after talking to the captain" (expedition leader, J. 9). Mountaineers talked about different possibilities (trying to get on a cargo ship, getting on a plane to Puerto Williams and finding a sailboat there and then, etc.). They finally decided to wait for the weather reports in order to make a further attempt to cross the Magellan Strait if necessary. If this new attempt failed, the expedition leader would return to Punta Arenas to seek information on alternative solutions. The discussion ended by pointing out that "... it doesn't prevent us from making other plans, but under no circumstances will we rush (...) because it would be a monumental mistake".

On the 10th day, after the failure of a new attempt to cross the strait, the expedition leader returned to Punta Arenas with two mountaineers. In radio contact with the captain of the boat, he gave indications on a new plan. Some of the mountaineers would board a cargo ship that would land them at the eastern end of the mountain range. But communication was very poor and raised many questions. The mountaineers met in the wardroom of the boat and engaged in great discussions. They tried to understand what the expedition leader meant and what the new plan would be based on the fragmented information received (*Who? Where? What? How?*). First of all, the conversations focused on the question of who would board the cargo ship, and who would stay on the Nueva Galicia (some of the mountaineers? The researchers? The Chilean guide?). Then, what would be the point along the mountain range where the cargo ship could drop them off? If it was indeed the eastern end of the mountain range, this would involve starting the crossing at the planned arrival point, facing the greatest difficulties from the start and against the prevailing winds. This itinerary had been precisely rejected for these reasons. Above all, this new plan would mean that mountaineers would have to be completely autonomous, without a mobile base camp or possible rescue, and would therefore have to carry very heavy bags. Questions then focused on what should be carried, depending on the type of ascent and the technical difficulties expected.

Mountaineer 1: So we should leave our excess equipment here!

Mountaineer 2: Yes, that's what is planned.

Mountaineer 1: So you have to sort it out!

Mountaineer 2: Yes, but what is the surplus?

The mountaineers were initially very hostile to this new plan. But at the end of the day, after two new radio links with the leader, they accepted it, focusing their attention on what to take or leave, and started packing their bags. This was a radical reconfiguration of the expedition project. It involved leaving the boat as a base camp, but also some of the food and equipment (which had implications for the type of ascent possible afterwards), taking a much more complex route and without the possibility of rapid rescue.

The mountaineers therefore effectively left the Nueva Galicia and boarded the cargo ship. After 36 h of sailing, they landed at the eastern end of the mountain range and began the crossing from east to west.

17.3. Implementation of a radical change in an extreme context

How can we explain the acceptance and implementation of this radical change of plan, to which the mountaineers were initially very hostile? In an extreme context, the continuous change and adjustment of existing plans to the emerging situation is crucial (Aubry and Lièvre 2010). Existing research has highlighted how difficult it is to drop the tools, even when it would allow you to run faster and escape the flames, as in the case of the Mann Gulch fire (Weick 1993). In highly risky and uncertain situations, communication, emotions and materiality can reinforce adherence to the frame of reference and slow down adaptive sensemaking (Cornelissen *et al.* 2014). The collective process of discursive meaningful construction is then decisive for developing a frame of reference adapted to the situation (reframing) and allowing the implementation of a change (Balogun and Johnson 2004; Cornelissen *et al.* 2014; Gioia and Chittipeddi 1991; Kaplan 2008; Maitlis and Sonenshein 2010; Weick 1988, 1995). However, few studies have examined processes of acceptance and implementation of radical change in highly risky and uncertain contexts, and how actors construct an alternative reference framework in real time (Cornelissen *et al.* 2014; Goffman 1981; Tannen 1985). In addition, the temporal and spatial dimensions of meaning construction remain poorly studied (Cunliffe and Coupland 2012; Kaplan *et al*. 2013). Real-time study of extreme contexts can shed light on these points.

We have a common approach to time with linguists. First, time is not only linear, but heterogeneous, complex and socially constructed. Thus, Hydle (2015) contrasts objective time and space with subjective temporality and spatiality and Biensethal *et al*. (2015) contrast clock time and event time. For Cunliffe *et al.* (2004, 2012), after Ricoeur, time is subjectively experienced. Narratives are acts of meaning construction that arise from different moments of time and discursive space.

Second, time is connected to space through the notion of chronotope related to discourse genres (Bakthin 1981, 1986; Cooren *et al.* 2014; Lorino and Tricard 2012; Pedersen 2009; Vaara and Pedersen 2013). In this perspective, the construction of meaning depends on how time is related to space in chronotopes, as opposed to a vision of sensemaking emerging from a change in the environment (Pedersen 2009).

The objective of the expedition was to cross a given area (the Cordillera Darwin) in a given time (40 days). We examined the role of time and space during this episode more specifically, because the loss of meaning came from a major obstruction in both time and space: eight days had already passed out of the forty days devoted to the expedition, and the mountaineers were still stuck at sea, 150 km from the planned starting point for the crossing of the Cordilleran mountains. We therefore sought to understand how the team members, through their discourses, reframed the situation and reconfigured time and space, and decided despite their reluctance to leave their boat and implement this radical change.

We have studied different aspects of this issue in three papers. The first paper (Musca *et al.* 2014) analyzed the role of discursive practices (reformulation, reframing, focusing attention) in the acceptance of a drop. A fourth discursive practice, "reaffirming team cohesion", made it possible to maintain links between team members despite the very high tensions throughout this episode. The paper current paper sheds light on the fact that beyond acceptance, the drop was effectively implemented. Finally, the third paper (Musca *et al.* 2016) uses the notion of chronotopes materialized by the boat and the camera to explain how the paradoxes of belonging and performance are constituted in time and space throughout the expedition.

17.4. Methodology

We explored these different aspects from data collected as part of the longitudinal study of the Darwin expedition (2008–2011) combined with the *in situ* and real-time ethnographic study of the six weeks of the expedition itself (Rix-Lièvre and Lièvre, 2010; Van Maanen 2006; 2011; Yanow 2009). A mountaineering expedition is a project (Hallgren 2007). The Darwin expedition was intended to accomplish a "first" in a highly uncertain, volatile and risky environment. The team members were isolated and out of their familiar context, and the methodological framework was intended to study what mountaineers were doing and saying in real time. Data were collected during the expedition at the individual and group level by four researchers who were on site in groups of two (Y. Giordano, G. Musca, M. Perez and L. Rouleau) and one remote researcher (P. Lièvre). I was myself on site in the boat with Yvonne Giordano and the mountaineers throughout this episode. The

data collected over these two days are mainly transcripts of recorded conversations (+55 pages), videos, the logbook of the 9th and 10th day of the expedition (+ nine pages), interviews, as well as mountaineers' and researchers' logs.

Data analysis was conducted jointly with linguists, with an abductive approach (Cunliffe and Eriksen 2011). We studied the process of constructing meaning during the episode, and conducted a discursive analysis using two types of data: the logbook and conversations. Linguistic analysis focused more specifically on how time and space were perceived and constructed based on the study of attributes related to spatiotemporal organization (values of time, expressions of time and space, semantic lexicon, subject type and text type). We were thus able to explore the co-construction of meaning and its sequential transformation in the progression of discourse.

17.5. The implementation of radical change: from boat to bags

The concept of chronotope has been used by various management authors to shed light on organizational processes (Cooren *et al.* 2014; Lorino and Tricard 2012; Pedersen 2009; Vaara and Pedersen 2013). We also used the notion of the chronotope of bird flight as a metaphor for the meaning of the expedition (Musca, Rouleau and Faure, 2014). However, in the current chapter, we want to return to Bakhtin. For this author, "in the chronotope of literary art there is *a fusion of spatial and temporal clues into an intelligible and concrete whole...*" (Bakhtin 1978). For Bakhtin (1981, 1986), the chronotope is rooted in a kind of discourse.

Our analyses suggest that the boat is a chronotope in Bakhtin's sense (Musca, Rouleau, Mellet, Sitri and de Vogüé, 2018a). It materializes an articulation of time and space, in a place that is at the same time closed, protective and collective, and in a movement in time and in the external space. The boat has a semantic meaning relating to the genre of the logbook (stories of great explorers, poetic register, etc.). The boat's chronotope organizes the narrative process. Its material anchoring has a fundamental role in the collective construction of the expedition's meaning.

> "In *front of us*, five albatrosses with protruding wings glide in the *wake of the ship*. They come and go soft and incessant, they seem to be carried by the wave of the south winds. Their natural ease contrasts with *our clumsy steps heckled by the ship's roll*. The wind is increasing. The cold rain burns our flabbergasted faces. *A splendid world ignorant of men and their high claims*. Here more than anywhere else, nothing is due to us. *We're just passing through*" (Webmaster, *Logbook*, D 12).

However, the obstruction of the boat broke this spatiotemporal articulation, since time passed when the boat was stopped and no longer able to travel through the outside space. The mountaineers gathered in the wardroom engaged in long conversations during which they tried to give meaning to the fragmented information on the new plan transmitted by the expedition leader. They thus engaged in a discursive process of reframing the situation in real time by articulating discordant temporalities and spatialities and two types of discourses (the *Logbook* and the conversations). But finding another articulation of time and space embodied in another object is difficult and takes time. It was only at the end of the 10th day that the bags materialized this new articulation.

Our analyses suggest that the transition from the boat to the bags chronotope is achieved through the transformation of discourse objects in conversations. Three questions (*Who? What? How?*) organized the progression from one discourse object to another, punctuated by the three radio links with the expedition leader. First of all, the conversations focused on the "who" (who should stay on the boat, and who should take the cargo ship), then we moved from the "who" to the "what" (what things to take or leave). Thematization and division of the "what" made it possible to move from the "what" to the "how" (what food and equipment, depending on how the crossing will be carried out, the difficulties expected and the number of days).

At the end of these two days, the mountaineers accepted to "drop the boat", packed their bags and effectively left the boat and implemented radical change. They moved from a collective space, in which they were advancing or being stopped together, to an individual space that they would walk through independently and exposed to danger. We suggest that the implementation of change is anchored in the transition from one chronotope to another, from boat to bags, and from one sub-genre to another (from logbook to travel notes). The new articulation of time and space was materialized in new objects: bags.

The role of time, space and materiality can thus explain why actors are so reluctant to drop the tools, but also to effectively implement radical changes in highly uncertain and risky situations. It was not only a question of accepting a new plan, but of moving from one specific articulation of time and space materialized by the boat to another, from one chronotope to another. And it took time, effort and collective discussion. Fostering connections between different types of interlocutors and discourse (logbook, conversations), and "giving them time" together helped this process.

And then what? The mountaineers left their boat that day, but the story was not over, and this boat would reappear and continue to play a fundamental role in building and exacerbating tensions during the Darwin expedition. As with any

expedition in a risky environment, team members faced fundamental tensions – accomplishing a feat/staying alive, individual/group, experiencing an adventure/telling a story. We tried to understand how the mountaineers formulated and transformed these paradoxical dynamics in the texts and conversations produced during the expedition. Our analyses of discursive micropractices suggest that it is a long, complex and constantly renewed process based on the creation of new semiotic objects (Musca, Rouleau, Mellet, Sitri and de Vogüé, 2018b). This research should be continued in order to better understand the role of discursive micropractices in reformulating tensions and implementing a change of plan during a project.

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SECTION 9

The Expansion of Knowledge

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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18

A Knowledge Corpus and Innovation

18.1. Creativity is not only based on imagination

In their most general form, classical creative methods (of which the archetype is brainstorming) are based on a principle of "divergence-convergence". They include a divergent thinking phase (moving away from the problem at hand, using subjectivity, analogy, imagination, to better come back to it from another angle) and a convergent thinking phase (transforming ideas into solutions that meet innovation objectives). These methods aim to produce as many ideas as possible in a short period of time, stimulating the imagination. In this area, there is a plethora of classic positive statements (see, for example, Louafa and Ferret 2008).

Despite their popularity, these methods have a number of disadvantages.

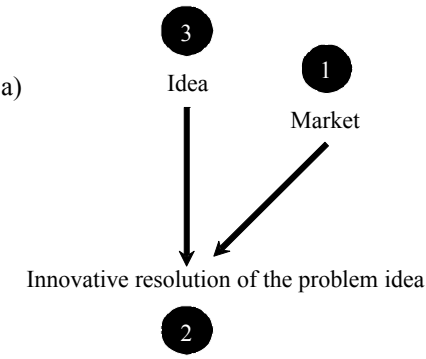
First, they are essentially problem-solving methods: they are solution-oriented and not idea-generation-oriented, which sometimes makes them unsuitable for general innovation processes. In an industrial context, innovation activities in the technical field are schematically based on two dynamics (see Box 18.1):

– the confrontation with a problem (reduced at a given moment to a technical dimension) leading to an innovative solution. It is a process of innovation in a closed environment: the problem to be solved;

– the idea having found a market. It is a process of innovation in an open framework.

Chapter written by Jean-Louis ERMINE and Pierre SAULAIS.

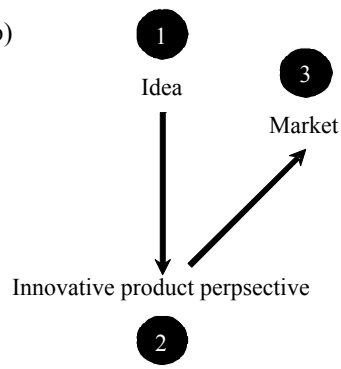
a)



In a), the framework of the reflection is described externally to the team of engineers. The driving force behind step 1 is the "market", in the sense of the customer requesting an addition or improvement or even a new product, often with specifications that already describe the required addition. To meet this problem solving request, the engineer must implement an innovative problem solving solution (step 2). To do this, they will seek new ideas to meet the specifications set (step 3). This principle of innovation dynamics is characteristic of a heteronomous operation (which draws its rules from the outside).

This is the dominant pattern in a traditional industrial company.

b)



In b), the framework of reflection is described internally, then externally. Step 1 starts with an idea, which step 2 will transform into an innovative product perspective. This perspective becomes an innovation if it meets a market (step 3). This principle of innovation dynamics is characteristic of an *autonomous* functioning (which gives itself its rules).

Box 18.1. *The two types of innovation dynamics in an industrial company*

In both cases, they rely on the production of ideas, which are the essential resource. Traditional creative methods are adapted above all to the first dynamic of innovation.

The animation techniques of classical creative devices appeal to the intuition and imagination of the actors, and little to their reasoning; they therefore do not really exploit their intellectual corpus. As for the company's knowledge capital, it is completely absent from these systems. The resulting innovations may, therefore, not integrate all the knowledge and expertise of the company, which is often a major element of its distinct competitiveness.

We propose here a method of creativity that calls on the profound knowledge of the actors and the company's knowledge capital. It is an unconventional approach, in line with what is now called "knowledge-based innovation" (Amidon 2001).

It makes it possible to broaden the scope of questions and innovation with respect to a vision of "specifications-based design" that is usual in a company. Its benefit also comes from the structuring and mobilization of knowledge actors in the process, which gives them a key role, which seems quite normal when we talk about the "knowledge economy"!

We will briefly define what a knowledge-based method of creativity is and illustrate it with examples (see Box 18.2). We will then look in detail at an example that has been tested at Thales Air Systems, a multinational defense company, in the civil and military radars production domain. The problem addressed in this example is that of determining the "products of the future" axes (technological roadmap), which raises the problem of the technological sectors to be mastered, and therefore the fields of knowledge to be supported. This is why the reflection was submitted to the different knowledge communities corresponding to the different fields.

This reflection was based on an extrapolation of past innovations and was presented to a strategic committee in order to align it with the company's technical strategy.

In this chapter, we will present successively:

– the problem of a knowledge-based method of creativity;

– the project as it took place in Thales;

– the conditions for the method's success.

18.2. The use of existing knowledge to improve creativity

The use of knowledge for searching for innovative solutions already exists in some industrial design methods. These are based on principles such as:

– analogy. This is the basic principle of the famous TRIZ method, a Russian acronym for "inventive problem solving theory", dedicated to solving technical problems requiring innovative solutions (Altshuller 1984). It shows that, when faced with a technical problem requiring an invention, it is possible to draw inspiration from solutions used in other fields to solve similar problems. It is typically a method of creativity, since it does not provide any means of concretizing the solutions obtained, and therefore requires a complementary process to provide an innovative design, and therefore knowledge that can be patented as an invention;

– the principle of expansion. For Hatchuel and Weil (2009), the principle of expansion is a central notion for any design theory. It is an intuitive notion expressing talent, discovery, invention and originality. Hatchuel and Weil developed the C-K theory in design engineering to formalize a true approach to creative design. This is one of the current examples of a knowledge-based approach, as innovation in design is constantly in control of the system's knowledge capital or actors' knowledge corpus.

In this chapter, we propose to rely on a new principle, which is that of "emergence-convergence", in line with the classic principle of "divergence-convergence" mentioned above, linked to a model of "chaotic" evolution of knowledge being created.

The process of creativity is similar to a process called "chaotic" (Gleick 1987; Prigogine 1996). Such a process is characterized by its "sensitivity to initial conditions" (SIC). This means that, in solving a given problem, the slightest variation in context leads to a very different result. This property characterizes a divergence phenomenon. As we know, many of the phenomena present in nature, whether physical, chemical, biological or even psychological, are chaotic in nature. However, in these phenomena, the introduction of a regulation loop allows a stable structure (an attractor) to emerge by filtering the outputs produced by the divergence, this is the emergence phenomenon. This structure is a new solution adapted to the problem at hand. The problem of creativity is well-situated in this context. The question then arises: by which regulation should a new and adapted solution emerge from a phenomenon of divergence?

The evolution of systems (especially biological systems, but not only) has studied this phenomenon of chaotic emergence and deduced a general model of evolution (Heudin 1998). A system is built on *structures* that can be *varied* by *energy* input. This transformation is regulated by *feedback* that confronts it with the

environment. These structures have a purpose that is expressed through *properties*. As they transform, these structures acquire new properties. In the evolution process, only those properties that are consistent with the system's purpose are retained, namely the *stabilization* loop. The ones that disappear correspond to what is called the *entropy of* the system. This operation of creating relevant properties is therefore an *emerging* phenomenon, since it is a new and adapted solution for the evolution of the system under consideration (see Figure 18.1.).

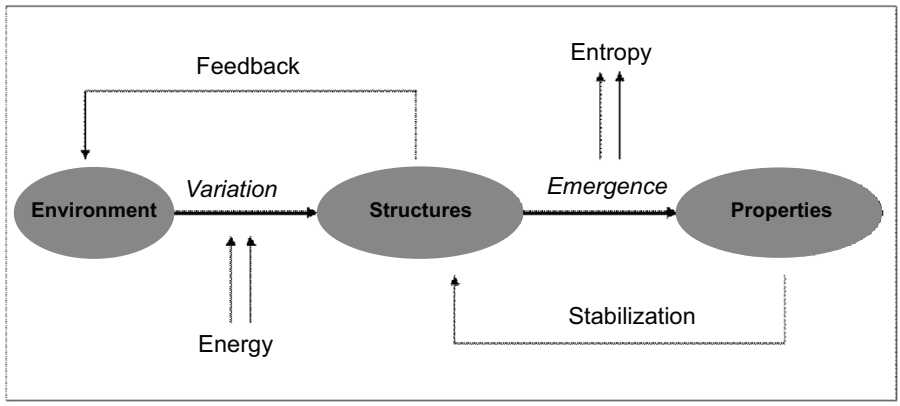


Figure 18.1. *The model of "chaotic" evolution through the emergence of systems*

This vision is very general and abstract. But if we consider that creativity is a process of idea generation, and that this process itself is a process of evolution of a company's knowledge capital, this theory of "chaotic" evolution by emergence can be adapted (Saulais and Ermine 2011).

The evolutionary structures in the general model are, in our case, structured *knowledge*. It will be enriched by a *cognitive stimulus* (the equivalent of the energy of the general model), which results, in our method, from a structured analysis of the existing knowledge capital. This stimulus consists of comparing this analysis with the cognitive corpus of knowledge actors (experts, organized in a creative community in the sense of Grandadam *et al.* 2010), who carry reference knowledge both on their external environment (markets, state of the art, etc.) and on the internal environment (the company's own tangible and intangible resources). This cognitive corpus is, therefore, a representation of the company's internal and external innovation *ecosystem* relating to the domain in question. The actors' cognitive corpus corresponds to the role that the environment plays in the general model. The result of the confrontation will create variations in knowledge structures in the form of new ideas that can change knowledge. This creativity is subject to an evolutionary

loop where new knowledge appears and in which a *reasoned* iteration eliminates variations that are too far away or too close to the reference knowledge and that are filtered through the organization by the possibility of putting them into action (*skills*). As the organization's activity corresponds to a productive purpose, new skills must generate productive *capacities*. *Strategic alignment* plays a stabilizing role in the overall model and helps to ensure that emerging skills are aligned with the organization's objectives. Those considered as *non-strategic capabilities* are not retained and correspond to the entropy dissipated by the system in the general model (see Figure 18.2).

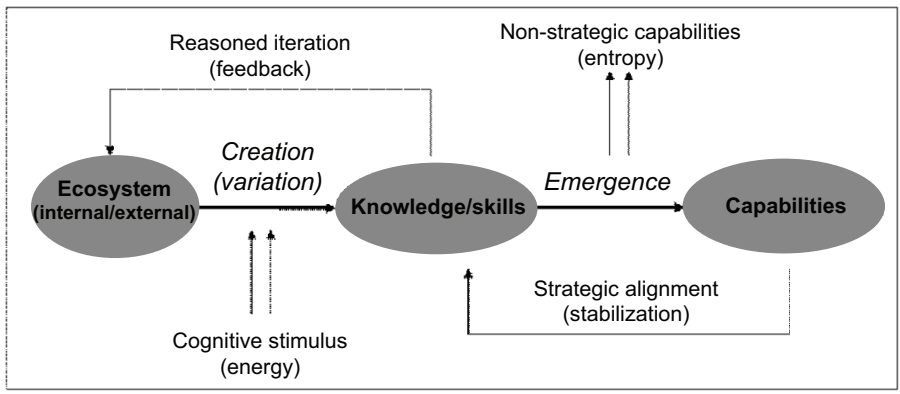


Figure 18.2. *The "chaotic" model of knowledge evolution by emergence*

This capability building operation is, therefore, an emerging phenomenon since the result is a complete structured product (innovative product possibilities) that makes sense for the organization. It corresponds to what biologists call "emerging quality". The framework described here allows us to set up an operational mechanism for generating ideas that is regulated, balanced and then oriented toward the company's objectives. This is what will be described in the next section (see also Box 18.2).

18.3. Case study: a creative process based on knowledge in Thales Air Systems

18.3.1. *The creative environment*

Thales is a world leader in the fields of defense, security, space, aeronautics and land transport, with 67,000 employees and an operational presence in 56 countries. Thales Air Systems is a group company specializing in surface radar defense

systems (for the navy, air force and army) as well as air traffic control systems and civil radars.

At Thales Air Systems, the innovation procedure is based on the "funnel model" in Figure 18.3.

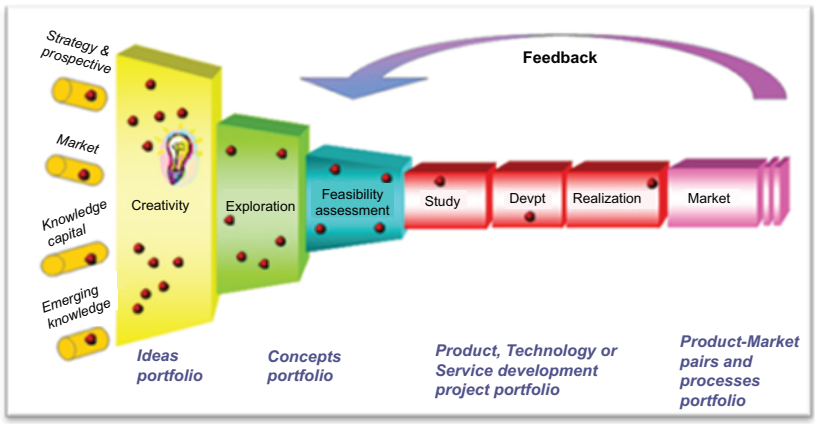


Figure 18.3. *The funnel model for innovation according to Gidel (2004). Instrumentation of multiproject management (Garel et al. 2004), cited in Fernez-Walch and Romon (2006, 2008)*

This innovation model, known as the "innovation funnel" or "innovation pipeline", has its origin in the development funnel model in project management (Wheelwright and Clark 1992). According to this model, the innovation procedure consists of an "upstream innovation" phase (idea generation, concept exploration, feasibility analysis and evaluation) and a "downstream innovation" phase (development field). The image of the funnel means that many ideas must be considered and analyzed in order to retain only one development in the end. Figure 18.3 details this process in terms of the different portfolios obtained. We note the essential feedback loop from products to ideas. The inputs of the funnel model are numerous: strategic and prospective elements, market data, existing knowledge (or expertise), emerging knowledge (or expertise). The allegory of the funnel illustrates a natural approach to the human mind, the process of which can occur without the need for formalization.

The project that has been tested at Thales Air Systems is located in the upstream part of the funnel (creativity: idea portfolio generation – exploration: concept portfolio generation), precisely where the company does not really follow a formal procedure.

The creativity methodology is essentially based on communities of practice (as defined in the special issue of Gestion), organized into "K&T" (Knowledge and Technology) domains. The concept of a "Knowledge and Technology Domain Portfolio" was introduced in 2005 in the Dutch subsidiary of the company. It aimed to identify the best specialists in a dozen knowledge areas (sensor systems, algorithms, antennas, signal generation and reception, software architecture, etc.) and to ask them to propose once a year technological roadmap elements in their knowledge area, with the objective of reducing risk in product development projects. The organization in K&T domains is motivated by the desire to rationalize knowledge creation and technological developments, capitalize and increase implicit and explicit appropriate technological knowledge and avoid the immobility resulting from the development of plans without activation. K&T domains are formed into working groups of five or six experts in the field, led by a chairperson (considered as the expert representing the field), who are asked to develop a medium-term plan for the K&T domain. These working groups benefit from the feedback of the previous year's technical and commercial strategic plans in their field. This concept is very ambitious and involves specialists and experts working very closely in the development and influence of the company, through an activity that is formally framed, informally open and managed. The action requested from experts (in the technical field) covers all prospective aspects: technical, technological, strategic, financial and economic intelligence.

It is within the K&T network that the creativity methodology has been deployed.

Other actors from the company were mobilized to ensure the validation and integration of the knowledge discussed and created during the process. In addition to the K&T network experts representing their field, the following were mobilized:

– peers, whose role was to react to proposals for prospective elements coming from representatives of the domains (from the K&T or outside the entity, domain or a complementary domain);

– field experts, in contact with customers (holders of technical knowledge in the field and customer), whose role was to provide the customer's technical point of view;

– the representatives of technical animation, whose role was to bring the point of view of "technical policy", in terms of technical and technological fields;

– the representatives of the entity's strategy, whose role was to provide elements of product and marketing policy.

In the following, we describe the process of creativity as it has been applied (see Figure 18.4).

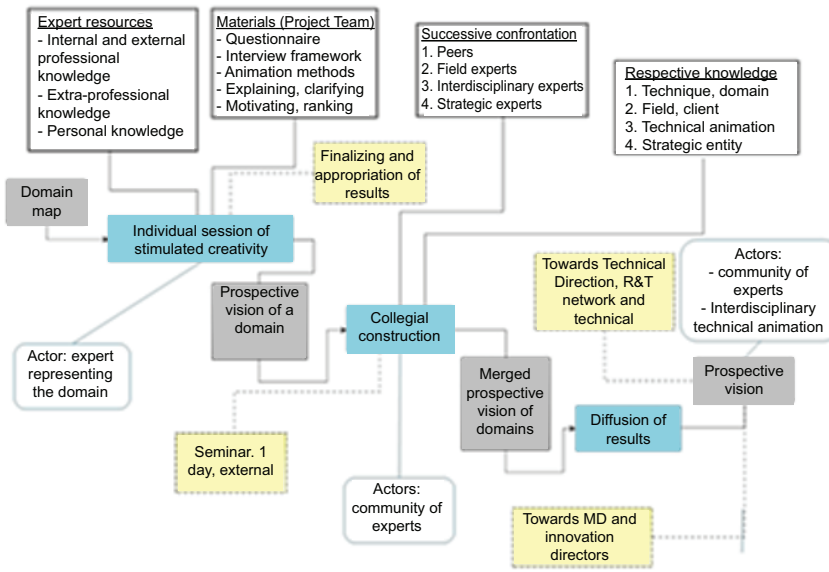


Figure 18.4. *The process of knowledge-based creativity*

18.3.2. *The creative process based on knowledge*

This process consists of three steps:

– the first is dedicated to individual stimulation through individual creativity sessions, the output of which consisted of prospective relating to the fields of knowledge;

– the second organizes the confrontation of individual results through a debate with a group of dedicated actors achieving the co-construction of a shared vision of all technical fields;

– the third concerns the dissemination of the assessment to the dedicated actors in the form of the prospective obtained, on the one hand, for experts in the field and on the other hand, for the other actors concerned by innovation in the company (innovation directors).

Before the final step of disseminating the results, the process took place in three phases, which we will describe in turn.

18.3.2.1. *Phase 1: analysis of tangible intellectual capital*

This phase corresponds to the generation of the cognitive stimulus – the "energy" provided to the system (for experts) in the model in Figure 18.2.

The first task of this phase was to create a representation of the "radar" technical object by structuring it into knowledge domains. This task is not as easy as it seems. The industrial vision of a technical object, the one shared by the company's actors, is closely linked to its production. Considering it as an object of knowledge, outside the context of production, is unusual and it is difficult to reach a consensus on a shared representation. In this phase, the radar object was broken down into 10 knowledge domains (antennas and RF/IR devices, digital processing equipment, servitude, modeling and simulation, algorithms, etc.). These 10 domains were in line with the internationally accepted job description (Barton 1976; Nathanson 1991; Skolnik 2002). The description of each domain was carried out according to the systemic approach (Bertalanffy 1968) including a functional point of view (what the system does), a structural point of view (what the system is), an applicative point of view (what it is intended for) and a genetic point of view (what it evolves into) constituted by the time axis of the other points of view. Figure 18.5 provides an example of a cognitive map (using Mind Mapping software) for the knowledge domain "algorithms", with the breakdown of functional, structural and application aspects into 11 "points of view".

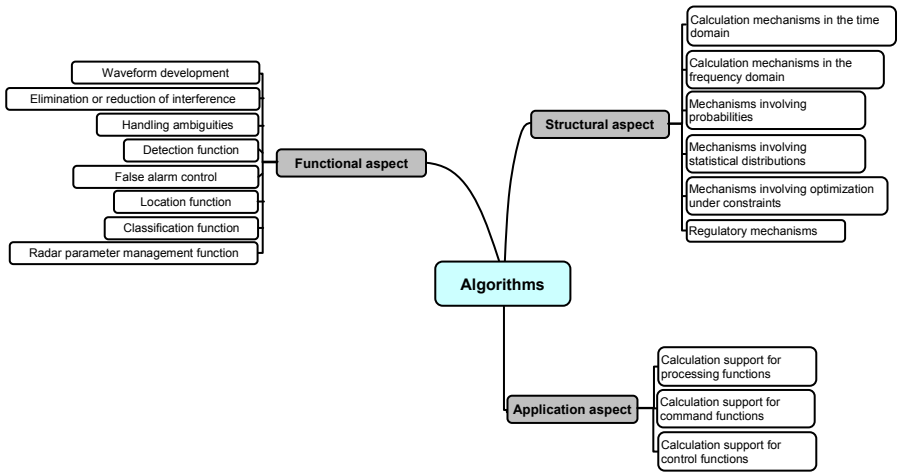


Figure 18.5. *Representation in the form of a cognitive map for the "algorithms" domain*

The second task of this phase was to index the company's intellectual production on the basis of the inventive traces of the last 30 years (patents, articles and communications, study reports, theses or internship reports, internal reports, white papers, presentations, training materials). The main difficulty of this task is the collection of data, dispersed in databases (patents), in unstructured directories (theses) or in documents dispersed throughout departments (internships, proposals, articles). The breakdown of each domain into functional, structural and application

aspects strongly helps with data collection. In fact, the majority of inventive traces, apart from patents, were not listed. It was necessary to visit the business units and people to collect the corresponding documents, which sometimes only remained in the employees' memory. For the project, three pilot areas were selected. First, the "K&T" expert recognized by the organization as representing each of the three knowledge areas of the experiment provided the initial list of major contributors to his knowledge domain. This list was expanded with other persons designated by successive co-optation during the author's interviews. A cross-checking of the traces was thus implemented to support or complete the individual statements.

The result is, of course, disparate according to the fields, because not all of them were helpful for inventive upstream activities. However, the approach is exhaustive and explicit, which means that all domains are analyzed in the same way and that the analysis can be clearly interpreted according to the domain.

An additional result of this phase is the creation of a database dedicated to the company's "inventive traces", of which a certain number of benefits were already identified (justification files for the research tax credit in France, capitalization of knowledge on upstream exploratory studies in technologies, etc.)

18.3.2.2. *Phase 2: stimulating the creativity of experts*

This fundamental part of the creativity method corresponds to the variation and feedback process of the model shown in Figure 18.2. It consists of stimulating the creativity of the experts by using the inventive trace analysis carried out in phase 1.

Individual creativity sessions include the following steps: presentation of collected traces and constructed trajectories, analysis of traces by the expert, statement of the expert's prospective vision. Each session lasts half a day and is fully recorded.

The analysis of the recordings and the summary of the session required a considerable amount of time to produce documents. Each field of knowledge has thus been the subject of a forward-looking document, controlled and validated by the expert, containing:

– the presentation of the domain as seen by the expert;

– for each subdomain represented in the knowledge map of the domain (about ten per domain):

- the presentation of the analysis of the intellectual corpus (traces) that was previously carried out on the subdomain;

- the expert's comments on this analysis;
- the projection into the future that these traces inspire in the expert;

– a summary made by the expert.

Three individual creativity sessions were held, each with the expert representing his field of knowledge. During these sessions, the three domain representatives expressed a strong appreciation for being asked to provide their own technical analysis of their own domain, as well as to formally develop and articulate their own vision of their domain. They thus found that the reconstruction of the main inventive trajectories of the last 20–30 years constituted a very appropriate pooling opportunity for the provision of the main ordered and reasoned elements of the chronological analysis of their own field. On the basis of these elements, they considered that their reflection was usefully stimulated to formalize the reasoning by the "why?", "for what?" and "what future after that?".

18.3.2.3. *Phase 3: collective co-construction of prospective*

This phase corresponds to the stabilization and emergence process of the model in Figure 18.2.

The initialization of this phase was made by the drafting of a prospective document summarizing the proposals of each expert that they had previously discussed among themselves in order to harmonize the different elements. These prospective elements were presented and defended by themselves in phase 3.

The prospective elements were successively confronted with different groups: technical peers, technical field experts and representatives of the organization's technical and operational strategy. This confrontation marked the transition from individual to collective creativity. We can thus observe the progress of a new idea within a technical community, the phenomena of appropriation and rejection. It was indeed a collegial co-construction, the result of the participants' constructive critical reflection based on their past and present knowledge. This phase was deliberately located beyond the walls to facilitate distance from the participants' daily tasks and functions. This phase also aimed at the strategic alignment of the college construction result by including prospective elements in the perspective of the entity's medium- and long-term strategy.

In the end, the document produced contains for each domain:

– the "focal points". These are the major issues that will determine future challenges;

– for each focal point, the action plans to be implemented to address the issues according to:

- what is currently in place;
- future trends.

After this phase 3, there is still the stage of dissemination to innovation actors, which must ensure that these reflections are taken into account in the downstream stages of the innovation process.

18.4. Lessons learned and conditions for success

The project that was carried out in the company made it possible to validate a knowledge-based approach to innovation:

– the company's intellectual capital contains basic elements that make it possible to trace a certain number of the organization's technological trajectories. *Finding and organizing these traces* has made it possible to forecast changes in a motivated way. The identification of the intellectual corpus over several decades, its analysis and its projection in the organization's knowledge map made it possible to identify the trajectories taken by the company, understand them and argue them;

– the tools described above are made for representing the intellectual corpus and they have been used to stimulate creativity. The creativity process is based on a chaotic emergence mechanism that will be applied to the existing intellectual corpus because of these representation tools. *The development of numerous prospective elements based on in-depth reflection articulated around the different temporal sections of inventive knowledge trajectories* shows the emergence of new elements likely to enrich the company's intellectual capital;

– the stimulation of creativity thus implemented applies initially to each of the knowledge actors, who are the carriers (individually or in combination) of the organization's technological trajectories. However, these trajectories are not isolated, and interact with each other in a complex network of interactions. This interaction network can be understood through the social network of actors (community of practice). In a second phase, therefore, the creation of new knowledge produced was *regulated by the intervention of the community of knowledge actors involved*;

– the project also showed that a reasoned contribution to prospective and technical strategy could be developed during a *bottom-up approach, based on the individual or collective use of a collection of experts' inventive knowledge*.

To achieve value generation in the sense of the organization, *the* new knowledge produced must pass through *strategic alignment filters* that guarantee the relevance of this prospective activity to strategic orientations. This phase still requires additional management involvement in the creative process.

18.5. Appendix

In a vehicle, the "door frame" is a much more complex object than it seems. It must be integrated into the car door, the passenger compartment, it has many constraints (waterproofing, for example) and it is a bit of a "signature" of the manufacturer (we think of the famous DS door frame, the doors of which did not have any frame!). The design of a door frame requires experience and know-how and there is a full-fledged door frame community that participates in all vehicle projects.

A few years ago, the automotive company PSA Peugeot Citroën initialized several projects using knowledge management methods to improve its incremental innovation processes in design (ground connection, door frame, etc.). We briefly describe here the project carried out on the design of door frames (Courteille *et al.* 2001).

This project was carried out by mobilizing the "door frame" technical community, and in particular the referent expert of this community, who fully participated in knowledge modeling and prospective.

Phase 1 consisted of choosing a description of a door frame in nine variables (the services) that were necessary and sufficient for the designer's work. Strangely, these design criteria (rigidity 1 and 2, habitability, waterproofing, accessibility, etc.) were part of the designers' tacit knowledge, but did not constitute "pure" design data (used in CAD – they have been more difficult to find in recent models in CAD databases than in older models with paper plans!).

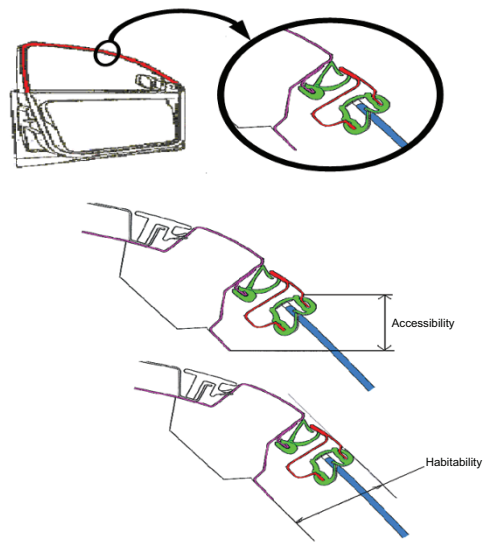


Figure 18.6. *The service of a door frame*

Phase 2 consisted of reconstructing the evolution of vehicle door frame performance since the 1950s (in fact, only 19 vehicles characteristic of PSA Peugeot Citroën's history were chosen by the expert). This work, known as knowledge drilling, was in fact long and tedious, as the data were not readily available.

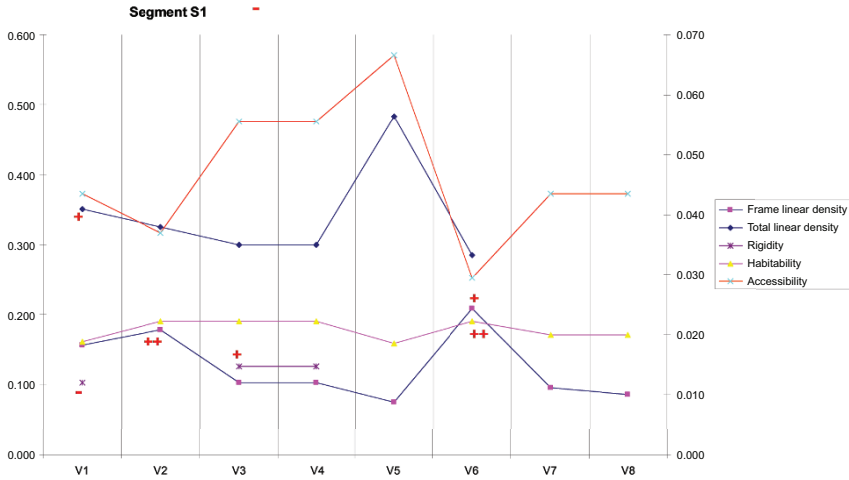


Figure 18.7. *The evolution of door frame services throughout the history of vehicles*

Phase 3 consisted of analyzing, with the help of the expert, evolution graphs to find evolutionary laws and incremental innovation potentialities. For example:

– a downward trend in a service was interpreted as the consequence of a requirement from another part of the vehicle, which caused a contradiction with the improvement of the service in question;

– a saturation law. One service proved to have a very uniform evolution profile, and no improvement over time, and more surprisingly even on some vehicles where this improvement was identified as a design priority;

– a stabilization law. A service, after a period of significant variation, was stabilized over time.

Phase 4 consisted of the expert making proposals to a strategic committee for the improvements of services based on the existing design context and with a view to triggering innovation processes. For example:

– in the first case, a collaborative reflection platform was agreed with the two design communities for the door frames and the other vehicle element in order to explore a compromise between the two conflicting requirements;

– in the second case, this service was very difficult to develop, only a disruptive innovation could make it possible to make progress on this point;

– in the third case, this stabilization was due to a certain control in service performance. It was then recommended, on this point, to renew the existing solutions which were at a satisfactory level.

Box 18.2. *Another example of knowledge-based creativity at PSA Peugeot Citroën*

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19

Community of Practice, Variation of Knowledge and Change in Extreme Management Situations

19.1. Introduction

The emergence of a new economic context since the 1990s has been reflected in numerous research studies by an intensive innovation regime (Eisenhardt and Brown 1998; Hatchuel and Weil 1999; Amin and Cohendet 2003; Foray 2009) where the ability to manage disruptive innovations is an essential issue (Henderson and Clark 1990; Le Masson *et al.* 2006; Ben Mahmoud-Jouini and Charue-Duboc 2008; Charue-Duboc *et al.* 2010;). Companies thus evolve in this context in an extreme management situation, simultaneously marked by change, uncertainty and risk (Lievre *et al.* 2010; Bouty *et al.* 2012). They thus move globally from an exploitation regime to an exploration regime that involves relying on knowledge expansion processes (Lenfle 2008).

Here, we define knowledge expansion as the evolution of an organization's knowledge base over time. Knowledge expansion therefore refers here to the ability of firms to change in response to external stimuli or the emergence of new ideas internally. This capacity for change is based on the firm's cognitive capacities and the way it implements them.

The literature on organizational change in management sciences identifies two main change models. In the first model, organizational change results from the aggregation of multiple incremental changes that take place mainly at the operational and middle management levels (Brown and Eisenhardt 1997). In the

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tradition of studying complex adaptive systems, change emerges from multiple interactions between actors, as well as between actors and their environment. In the second, change is decided by central actors, usually senior management, who mobilize and adapt the organizational structure to implement it (Tushman and O'Reilly 1996). In this more mechanistic approach to change, the company's management has the ability and power to lead agents to adapt their behavior to the new strategic line.

The central proposal of this chapter is that these two change models within organizations can be interpreted through the prism of communities of practice.

Communities of practice (CoPs) (Lave and Wenger 1991; Wenger 1998; Wenger *et al.* 2002; Cohendet *et al.* 2006; Amin and Roberts 2008; Bootz and Kern 2009; Cohendet *et al.* 2010) have long been identified as particularly agile social structures for knowledge management, especially in terms of dissemination and sharing, but how do these social structures manage to respond to these extreme management situations? What are their capacities to provoke or absorb radical changes and to develop knowledge expansion processes?

In order to answer these questions, we begin by presenting the community of practice as a self-organized social entity built around a practice and argue that such structures can bring about change locally and interact with each other to achieve visible change at the level of the organization as a whole. We then turn to the conscious mobilization of such communities by management, i.e. the establishment of pilot communities of practice (PCoPs), to advance the idea that communities can be a support to the management of change initiated or desired by the organization's management.

19.2 Emerging change and knowledge variation through spontaneous CoPs

19.2.1. *Change as an emerging process*

An important current in literature sees change as an emerging process that takes place mainly at the operational levels of the organization. In this conception of change, organizations evolve through multiple relatively incremental and local changes that combine to eventually result in major visible changes at the organizational level (Brown and Eisenhardt 1997; Garud *et al.* 2013; Tuertscher *et al.* 2014). In this approach, change largely escapes intelligent design. Hierarchy and top management are largely absent from the processes leading to change. Instead, the change is described as the result of many interactions at the operational

and middle management level in the course of day-to-day activities. The actors then lead multiple local variations that end up together producing a significant change for the organization. The change described in this way consists of a progressive alteration of processes and more precisely of all the practices that constitute them (Tsoukas 1996; Tsoukas and Chia 2002; Langley *et al.* 2013). Changes that may originate in the firm's environment, in the work context or in local initiatives of the actors lead to changes in the practices and knowledge associated with them (Feldman and Pentland 2003).

19.2.2. *CoPs as a mechanism for developing and modifying practices*

Work on situated learning (Cook and Brown 1999; Tsoukas and Vladimirou 2001) and on the notion of practice (Gherardi and Nicolini 2000; Gherardi 2006; Gherardi and Perrotta 2011) has identified communities of practice as the social mechanism to support practices, both within and outside organizations (Brown and Duguid 1991; Lave and Wenger 1991; Wenger 1998).

Communities of practice are informal structures that focus on developing a given practice and the knowledge associated with it (Hara 2009). Communities emerge around a given practice. It is therefore the practice that is the constitutive element around which actors sharing a common interest in this practice will meet and aggregate (Gherardi 2006). In addition, as an informal group, communities of practice do not have clear boundaries and do not fall under any explicit hierarchy that would be able to monitor compliance with procedures or the quality of the work provided (Wenger 1998).

Repeated interactions between actors around a practice strengthen the links between them. Once established, communities integrate strong links between their members. These links are based on the passion and commitment of each member to a common practice (Wenger 1998; Schenkel and Teigland 2008). Interactions between members of a community are governed by trusting relationships based on respect for norms. These norms themselves emerge from the repetitiveness of interactions between members and significantly reduce opportunistic behavior, replacing it with mechanisms of peer cooperation and effects of reputation (Cohendet *et al*. 2006; McDermott and Archibald 2010).

Trust can be measured by the fact that, in the face of unforeseen events, individuals' behavior is guided by respect for norms established within the community and not by contractual schemes. As a result, the concepts of contracts and incentive compensation are secondary or even totally absent. Communities cannot be instrumentalized. The repetitiveness of interactions within communities significantly reduces opportunistic behaviors (such as a "moral hazard") that are

replaced by norms of cooperation and reputation mechanisms (Bowles and Gintis 2002).

Finally, knowledge communities have life cycles, from their emergence to their maturity and, eventually, their death. Each of these stages has its own specific structures and modes of knowledge production and practices (Gongla and Rizzuto 2004).

In view of this rapid synthesis of the literature on communities of practice, the latter appear to be the social mechanism that supports the practices that constitute the different organizational processes. In addition, in line with the emerging and bottom-up vision of change presented above, communities of practice escape direct management control and constitute efforts to develop and evolve practices in the context of daily work (Brown and Duguid 1991). It is therefore possible based on the concept of community and the many works on the concept (Amin and Roberts 2008; Murillo 2011) to refine our understanding of this type of change.

To do this, it is necessary to be aware that (1) within communities, members can easily engage in a variation in knowledge and (2) variations can, under certain conditions, spread and combine within a constellation or network of communities. Changes can then be combined to result in large-scale change.

19.3. Change leads to constellations of communities

19.3.1. *Knowledge variation and change within communities of practice*

Within the community's boundaries, changes and adjustments are possible. Why are changes possible? Communities of practice are built around practice itself. However, many studies (Brown and Eisenhardt 1997; Feldman and Pentland 2003; Gherardi 2006) point out that practices are constantly subject to variation. The practice is always changing and subject to variations caused by changes in the environment (competitive, technological, legal, etc.). Communities seek to consistently change the practices around which they have aggregated (Hara 2009). In response to these external stimuli, communities are specifically tasked with the evolution of practices and the associated body of knowledge.

Because there are shared common norms and knowledge, as well as a shared understanding of the practice around which the community has been federated, communication, coordination and cooperation are comparatively simple within the same community of practice. However, the existence of shared norms and representations ensures that within the community, members' efforts are aligned, thus avoiding a permanent oscillation between different practices and knowledge

(Mihm *et al.* 2003). The literature on communities of practice also shows that communities are not fixed structures, but capable of constantly changing and adapting to changes in external conditions or changes in member relationships (Huberman and Hogg 1995).

However, communities can close in on themselves and become more rigid because of the social structures built within them or the power games taking place both within them and between communities (Bowles and Gintis 2002). These social and political failures can lead to closure and isolation of the community, which will then refuse changes from outside and the evolution of its practices (Ferlie *et al.* 2005). Nevertheless, the practice and adaptation of practices to the environment is a powerful driving force and communities of practice will in most cases evolve their practice under threat of disappearing (Gherardi and Perrotta 2011).

More generally, the changes that communities of practice lead cannot be of the radical type. Learning modalities, underpinned by community norms, the repertoire of possible knowledge and responses maintained, as well as the world representations that have been collectively developed, limit the scope for change in which a community can engage. In other words, communities of practice can change incrementally and relatively frequently but are unlikely to make radical changes. Ultimately, if the environment or the emergence of a new idea within the community forces a radical change in practices, the community will dissolve and one (or more) new communities will be formed around the (radically) new practice.

The magnitude of the change observed at the organizational level then results from the combination of multiple changes made in different communities.

19.3.2. *Propagation and combinations of variations in a constellation of communities*

As a matter of principle, within each community, there is common knowledge, communication systems and standards that allow for rapid consensus to be built. The difficulty lies in linking knowledge between communities. A community can connect with one or more other communities sharing similar cognitive objectives, so that large networks of communities can be formed in which knowledge flows relatively easily. Organizations can thus be seen as a community of communities (Cohendet *et al.* 2006), a constellation of communities (Wenger 1998) or as community networks (Brown and Duguid 2001).

In order to coordinate the different communities, the existence of an objective common to all the communities or at least a sufficient convergence of interest is apparently a necessary condition for the convergence of the constellation of

communities toward a stable and satisfactory state in terms of performance. The existence of a knowledge base common to all communities in order to facilitate intercommunity understanding and/or a communication system that makes it possible to move toward synchronous communication (in both cases, the gaps between the different representations of the world are reduced) are important assets (Mihm *et al.* 2003; Tuertscher *et al.* 2014).

Nevertheless, even in the absence of a common knowledge base, different ways of building bridges or links between communities through which knowledge can flow have been identified in the literature. First, communities typically have blurred boundaries and peripheral members may belong to several communities simultaneously. They then play the role of boundary spanners, or knowledge brokers between communities (Brown and Duguid 1991). Second, different communities can voluntarily engage in a process of knowledge exchange, then implementing various processes of knowledge translation and transformation so that each of the communities involved in the exchange can make sense of the constraints and objectives of the other (Bechky 2003; Carlile 2004) by recontextualizing knowledge from outside within each community in order to initiate a dialogue with outside. Finally, the environment can provide material supports, boundary objects around which communities can coordinate without fully understanding the world of others (Star and Griesemer 1989).

For example, in his seminal paper, Bechky (2003) explained that during the development of new products different communities – engineers, technicians and assemblers – manage to coordinate despite different representations of the problems to be solved. To do this, communities engage in a discursive process around the prototype during which communities manage to make sense of the knowledge of other communities. In doing so, the community's knowledge inventory is modified to incorporate this new knowledge.

In cases such as this, community boundaries are not altered. The different modes of coordination mentioned above work well when the change in the constellation of communities consists of a recombination of existing practices. In other words, they are effective when it is sufficient to modify the interfaces between the different practices, while the latter remain relatively unchanged.

When the magnitude of change is greater, informal communities must have the capacity to negotiate boundaries and interfaces between communities because it is the practices that determine the community (Gherardi 2006). So in the definition of practices, the boundaries of communities are negotiated. A change in practices will lead to a renegotiation of borders: inclusion/exclusion of certain pieces of knowledge and reinforcement/weakening of certain links between elements of knowledge (Tuertscher *et al.* 2014).

In the adaptation of CERN's accelerator to detect the Higgs boson reported by Tuertscher *et al.* (2014), the various scientific communities involved (electronics engineers, high-energy physicists, detector specialists, etc.) had to renegotiate the boundaries of their knowledge and practice to coordinate themselves. This redefinition of boundaries involved identifying the knowledge points that needs to be renegotiated and adapting each community's body of knowledge to the changes made to each of these contact points between different knowledge areas. Unlike the previous case, communities here must modify their boundaries to include/exclude certain knowledge elements and adapt their knowledge repertoire to these changes.

When the changes are radical and when they involve a profound change in the practices themselves, they will require a redefinition of the boundaries of each community involved. When change is more radical, it implies that communities redefine what is part of their practice and what is outside (Gherardi and Perrotta 2011).

In some cases, the redefinition of interface knowledge may lead the communities concerned to review their knowledge base.

In their study of the impact of the amendment of the law on *in vitro* fertilization in Italy, Gherardi and Perrotta (2011) show how a major institutional change forced doctors and biologists to redefine what was part of their respective practices and what should be left outside their community (and managed by another community).

The constellation of communities must then, on the one hand, dissolve the old links and, on the other hand, create new ones (Law 2000; McKelvey 2000). This implies that some communities may potentially disappear, while new ones may emerge. It is possible that the temptation of isolationism and closure is the greatest in this type of situation. If adaptation requires the destruction and recreation of communities, then destruction must be relatively easy, but building a new community will take time. Ultimately, if too many communities are to be destroyed/constructed, it is not clear that this approach is possible.

19.4. Induced change, knowledge expansion and pilot communities of practice

There are a number of limitations to allowing change to emerge from informal and self-organized communities of practice. As we have seen, these social structures are not immediately oriented toward radical changes and the expansion of knowledge. These processes involve complex models of articulation between communities that can take a long time to set up and that are beyond control because

of their emerging nature. This non-interventional policy also exposes the organization to the risk of seeing communities with high potential die out or some of them appear around non-key activities for the organization. There is also a risk of identity drift, stagnation in routine or the creation of rigidities (Cohendet *et al.* 2006).

In order to avoid these risks and to better control the dynamics of knowledge expansion and change management, organizations are increasingly trying to manage these social structures. Examples of organizations that have tried to establish these PCoPs within them have multiplied in recent years: Siemens (Probst and Borzillo 2007), British Petroleum (Cohendet *et al.* 2006, 2010), IBM (Gongla and Rizzuto 2001; Bootz and Borzillo 2015), the Council of Europe (Creplet *et al.* 2009; Creplet and Dupouet 2009), GDF-Suez (Blanchot-Courtois and Ferrary 2009; Gosselin *et al.* 2010; Dupouet and Barlatier 2011), the United Nations (Bootz and Borzillo 2015) and Schlumberger (McDermott and Archibald 2010). This development of PCoPs faces a major difficulty: the ability to manage the self-organization/control the tension that these structures generate.

19.4.1. *Leading change through managed communities of practice: a tension of self-organization/control*

The community of practice is at its origin, as we have seen, basically informal and self-organized. Wanting to manage it is almost nonsense, which sometimes leads companies to "force the concept" (Cohendet *et al.* 2010). CoPs are inherently resistant to control and interference because of their spontaneous nature (Wenger and Snyder 2000). For Wenger (2005, p. 11), "their value lies precisely in the fact that they possess the competence, perspective and practical experience they need to take charge of their own governance". The management of a CoP thus entails a risk of destroying the complex reciprocal relationships on which it is based (Daunais *et al.* 2010). It is thus necessary to succeed in "stimulating without stifling" the community's activities (Josserand and Saint Leger 2004) through "non-intrusive support" (Grimand 2006, p. 150). This implies going against the standard managerial culture, which does not tolerate the existence of uncontrolled spaces and avoiding succumbing to the "temptation of the hierarchy" (Josserand and Saint Leger 2004). This temptation is at maximum because the institutionalization of these structures can transform them into objects of desire and individual promotion for managers. For organizations engaging in such an approach, the difficulty lies in managing communities. It is indeed necessary for them to produce elements in line with the firm's concerns, without stifling the self-organized dimension that is of interest to them. For Gosselin *et al.* (2010, p. 37), this "antinomy between a positive hierarchical affirmation that creates spaces for sharing and the limited role of

management constrained by the imperative of freedom that these same spaces imply does not mean that these movements are irreconcilable".

Two mechanisms make it possible to make this delicate trade-off: governance based on the roles of manager and sponsor and the setting of objectives and deliverables (Probst and Borzillo 2007; Borzillo *et al.* 2008; McDermott and Archibald 2010; Bootz 2013, 2015).

The role of the sponsor, usually a person at a high level, is to ensure that the community for which they are responsible has the resources and time necessary for its functioning while ensuring that the community's activity remains in line with that of the organization (Wenger and Snyder 2000; Dupouet and Barlatier 2011).

The manager is responsible for ensuring effective cooperation and strengthening trust between members (Lesser and Everest 2001; Buchel and Raub 2002) to enable them to exchange knowledge, in particular through the layout of the workspace and the provision of tools (Wenger *et al.* 2002; McDermott and Archibald 2010; Borzillo *et al.* 2011). In this context, they become a "knowledge gardener who must prepare a fertile ground for communities to flourish" (Cohendet *et al.* 2010). They are responsible for giving "a soul" to the community by actively participating in the construction of its identity (Gosselin *et al.* 2010, p. 43).

Overall, the maintenance of the self-organized dimension is ensured by the manager/coordinator while control is the responsibility of the sponsor. The latter can thus go so far as to set quantitative objectives for the community. This quantification of objectives is the subject of debate between those who perceive these objectives as a motivating factor (McDermott 2002, 2004, 2007; Probst and Borzillo 2007) and others, who see in these normative approaches a "conceptual diversion" that distorts the foundations of the CoP by challenging their self-organization and identity mechanisms (Josserand 2004; Josserand and Saint Leger 2004; Dameron and Josserand 2007). Wenger (2005) reconciles the points of view by considering that the measure has undeniable virtues for communities and their members, provided that it is sufficiently relevant to really evaluate its contributions.

However, a consensus is emerging between these different positions. Indeed, even supporters of strong governance admit that to preserve a self-organized dimension, these structures must at least be built around internal norms that are co-constructed through the repetition of interactions between members (Creplet and Dupouet 2009; Dupouet and Barlatier 2011). PCoPs must, therefore, encourage the creation of a secure space allowing a freer expression of ideas than within formal units (Probst and Borzillo 2007). This environment is thus conducive to knowledge sharing (Dupouet and Barlatier 2011) and has a positive impact on community

productivity (Millen *et al.* 2002). Maintaining these standards is the responsibility of the manager/coordinator.

19.4.2. *PCoPs and knowledge expansion: exploration and exploitation*

Recent empirical studies highlight that PCoPs include practices that are differentiated according to the internal environment (Josserand 2004), the level of maturity (Wenger *et al.* 2002; Dameron and Josserand 2007), the degree of institutional formalism or the governance structure (CEFRIO 2005). Recent empirical research (Probst and Borzillo 2007, 2008; Borzillo *et al.* 2008; McDermott and Archibald 2010; Dupouet and Barlatier 2011; Bootz 2015; Bootz and Borzillo 2015) partly structures these diversification criteria by proposing PCoP typologies with differentiated roles in knowledge change and expansion. A recent summary (Bootz 2015) allows the identification of two main types of PCoPs: strategic exploration PCoPs (SE) and operational exploitation PCoPs (OE).

19.4.2.1. *Strategic exploration communities*

Strategic communities (Probst and Borzillo 2007, 2008; Borzillo *et al.* 2008) focus on the continuous exchange of innovative ideas across the organization's divisions. They correspond in this respect to what Dupouet and Barlatier (2011) refer to as exploration PCoPs (in the sense of March 1991) insofar as these communities aim to produce new knowledge that is of strategic importance for the organization. As such, they benefit from real support from management through active sponsorship. In this context, the manager not only ensures internal coordination, but also the reporting of the community's activities to the sponsor via the organization of multiyear meetings. This provides an opportunity to review the most promising practices in terms of innovation and performance. The results obtained can be quantified (increased income/market share and/or cost reduction) and used as a means of promoting the community. Knowledge from these communities thus circulates essentially vertically (Dupouet and Barlatier, 2011). These PCoPs can be found in structures where innovation is a key factor in competitiveness (Probst and Borzillo 2007; Borzillo *et al.* 2008; Dupouet and Barlatier 2011). At Siemens for example (Probst and Borzillo 2007), 250 engineers are grouped together in a PCoP and meet every 3 months to exchange and evaluate innovative processes concerning automotive system automation processes. These exchanges are facilitated by the establishment of a large virtual platform funded by management. A sponsor is in charge of controlling the community's productions and directs management's investments toward the most promising systems for innovation. To do this, it is based on reporting by the manager, showing in particular the savings achieved and/or the technical progress linked to these new systems.

The strong self-organization/control tension within these PCoPs is a key issue for these structures. Given their strategic dimensions, these communities are generally created *ex nihilo* under the watchful eye of management and their governance through the sponsor can be strong (quantified objectives, results control, reporting, etc.). The absence of passion *stricto sensu*, combined with the interventionism of management, implies that the main danger facing this type of community is its disappearance, or even its shift toward a hierarchical functioning (Gosselin *et al.* 2010). In this context, it is essential that over time, a mode of operation based on a system of shared and co-constructed standards emerges (Probst and Borzillo 2007; Dupouet and Barlatier 2011). It is essentially this dimension that is the driving force behind the participation of members and makes it possible to maintain a relationship with spontaneous and self-organized CoPs.

This tension can also be managed dynamically by a gradual disengagement of the sponsor and manager for the benefit of members so that real community mechanisms emerge (Gosselin *et al.* 2011). The manager, in particular, must perceive when to start erasing themself and manage the process of transferring part of their responsibilities. The success of piloting thus requires overcoming its "original artificiality", by encouraging the gradual appearance of a form of non-piloting (Gosselin *et al.* 2011). This question of the progressive empowerment of a community created *ex nihilo* has not yet been the subject of much empirical insight. The way in which this gradual disengagement can be achieved in practice remains to be explored.

19.4.2.2. *Operational use communities*

Operational communities (Probst and Borzillo 2007, 2008; Borzillo *et al.* 2008) are composed of members who transfer technical and operational practices to each other to optimize their daily activities. These communities are clearly oriented toward exploitation (Dupouet and Barlatier 2011) insofar as the objective is not disruptive innovation, but the emergence and dissemination of good practices to improve current operations (Probst and Borzillo 2007).

The objectives are determined by the manager and focus on improving the technical dimensions of practices, such as processes or methods. The manager controls and validates members' practices to maintain the operational excellence of the community. They assess the skills of the various community members and articulate them to carry out all activities. The manager must therefore not only promote spaces for socialization, but also manage them. In order to carry out all their missions, the manager must thus benefit from a real cognitive and social legitimacy as an expert (Bootz and Schenk 2013; Bootz 2015). To the extent that these communities are not generally initiated by management or considered a strategic priority, sponsorship is lower than for strategic exploration communities. Knowledge flows are mainly horizontal, directed to an audience of specialists who

can immediately put them into practice. The knowledge produced is controlled by these communities so that they remain confined to professional networks in the field (Dupouet and Barlatier 2011).

These operational PCoPs are in most cases part of the institutionalization of informal and self-organized CoPs. The hierarchy will therefore support these communities by asking them *a minima* in exchange to codify and transfer their good practices, so that the entire organization can benefit from them. In this context, the main problem concerns the type of management that can be proposed to these communities without questioning their pre-existing operating mode based on self-organization. For example, it is not necessary to impose an external manager on the community, but to choose an internal expert appointed by the community members (Bootz 2015).

In a longitudinal study over more than 10 years of the Radio France sound recording community, Bootz and Lievre (2014) emphasized that the management of a spontaneous community is only possible if the related structuring makes sense for the members of the community and corresponds to a stage of reification in the community's development. This reification serves as a support for the participation and mutual commitment of members.

The management of a spontaneous CoP is no longer considered in this perspective as a disruption, but as a continuity of the reification/participation process already at work within the spontaneous CoP.

19.4.2.3. *PCoPs and ambidexterity*

The distinction between exploration and exploitation PCoPs gives rise to reflections on the impact of these structures on ambidextrous capacities, i.e. on the ability to manage tensions between "the improvement and extension of existing technological skills and paradigms and the experimentation of new alternatives" (March 1991). Dupouët and Barlatier thus underline that PCoPs constitute a support to contextual ambidexterity (Gibson and Birkinshaw 2004) by offering a context combining performance requirements and creativity incentives. The exploration/exploitation tension is, according to the two authors, resolved at the level of the individual, who will choose to create or participate in PCoPs oriented toward either exploration or exploitation.

Recent empirical work carried out in nine organizations (including Daimler, IBM, Siemens and the United Nations) highlights that in reality exploration and exploitation activities are not always supported by dedicated PCoPs and that there are forms of ambidextrous emissions within these PCoPs (Bootz and Borzillo 2015). Some operational operating PCoPs are thus gradually being transformed into exploration PCoPs. This is particularly the case with IBM's CPoP Knowledge

Tools, whose initial objective was to optimize the knowledge management tools used in the various divisions of the organization through the sharing of knowledge and good practices and which has gradually developed strategic reflections on new KM models/tools/methods through knowledge exploration in parallel with these exploitation activities. There are also PCoPs that go through a reverse dynamic from exploitation to exploitation, such as the "E-Government" PCoP at BearingPoint. In practice, PCoPs can be found that allow the development of a sequential form of ambidextrous extremes (Puranam *et al.* 2006; Venkatraman *et al.* 2007).

But we also find in this same empirical study that PCoPs are capable of withstanding simultaneous ambidextrous conditions (Gupta *et al.* 2006; Raisch and Birkinshaw 2008). In some PCoPs, ambidexterity is indeed inscribed in the "genes" of the community with objectives including both exploitation and exploration activities, such as the PCoP "Power Systems" at Daimler, which aims to improve knowledge of electronic components and systems, and also to develop new knowledge on these subjects. These results are consistent with the longitudinal study conducted by Radio France, which points out that the PCoP of sound recorders is also ambidextrous (Bootz and Lièvre 2013).

PCoPs thus allow, through the different cognitive activities they support (exploitation/exploration/ambidexterity) in terms of the hierarchy, powerful levers to support the processes of change and expansion of knowledge. This, all the same, implies managing complex piloting and governance processes both to maintain a dose of self-organization within each PCoP and to articulate these different communities between them and with hierarchical structures (cognitive architecture).

19.5. Conclusion

The expansion of knowledge and change can thus be accompanied by spontaneous CoPs, particularly through their interactions, but involve risks for the hierarchy, linked to the emerging and uncontrolled nature of the process. In order to avoid these risks and increase control, it is then to use managed CoPs to develop exploitation and knowledge exploration activities or even to carry out both activities simultaneously. The difficulty in this case is to rethink the management methods in such a way that they do not call into question the self-organized nature that is the driving force behind PCoPs in terms of knowledge development.

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20

Expanding Knowledge and Mobilizing Social Networks

20.1. Introduction

Contemporary organizations are subject to increased demands for knowledge management in response to both the injunction to innovate (Alter 2000) and the rapid transformation of the knowledge and technologies used, what some authors call a knowledge economy era (Foray 2000; Amin and Cohendet 2004). Facing these situations of innovation then requires the mobilization of new knowledge, well in advance of the development of their collective actions. The aim is to access, apprehend and even create, in a given time, new knowledge that is relevant, absorbable and usable in a situation, whether it is in the scientific register or in the experiential register (Lièvre 2016). Two types of questions arise: how can we mobilize relational resources for exploration purposes and how can we ensure the cooperation of the people involved? What type of knowledge do they provide access to and how can we ensure their relevance?

We try to clarify the process of knowledge expansion from the corpus of social network theory. We also review the two major streams of research on social networks (Granovetter 1973; Burt 1992), and then show the implications and limitations of each from the perspective of knowledge expansion. Third, in response to the question raised by the cooperation of actors involved in a process of knowledge expansion, we revisit the definition of the weak tie according to Granovetter (1973) and propose the notion of a weak tie potentially strong alone capable of accounting for reticular processes in knowledge expansion.

Chapter written by Marc LECOUTRE.

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20.2. Innovation, network and knowledge expansion

The new rules of the game of an innovation-oriented knowledge economy are being created in part away from standard forms of management. How is continuous adaptation, creation and learning of new knowledge to innovate achieved? If the project mode is becoming more widespread, dealing with these new, unprecedented situations, which are increasingly similar to extreme situations, requires entering a process of knowledge expansion (Lièvre 2016). It is an exploration logic that involves radically moving away from one's usual basis, from one's well-known environment in order to access and mobilize the resources and knowledge needed for successful projects (Lecoutre and Lièvre 2010). In these new situations, the knowledge needed to carry out innovative projects is no longer only stabilized, clarified and accessible at all times. They are largely tacit, integrated into the practical experience of individuals, specific to the situation under consideration and must be sought, created, learned and mobilized through unscheduled interactions.

How is this new knowledge accessed? This is the whole point of relational resources. In a generic way, relational capacities and resources appear crucial for collective action (Lecoutre and Lièvre 2009). When the organization can no longer prescribe, everyone is referred to their own ability to identify the partners necessary to carry out their work as well as possible, and thus to generate, maintain and develop their relational network. It becomes a prerequisite for exploring new fields (Cohendet and Diani 2003), stimulating creativity (Burt 2004; Perry-Smith 2006) or creating successful projects (Garel 2003). Thus, a consensus is emerging on the issue of relational dimensions in collective action today. In addition, a recent major review (Phelps *et al.* 2012) shows the increasing development of work focused on knowledge networks, combining theoretical approaches on social networks with those on mechanisms for the production and dissemination of knowledge and expertise. If interacting is learning (Borgatti and Cross 2003) and if knowledge is not limited to explicit, objective and codified knowledge, then the issue of knowledge expansion in organizations cannot avoid integrating the theoretical contributions of social networks.

20.3. Expanding knowledge: two examples in uncertain and risky situations

What does it mean to access new knowledge? To illustrate this, we propose here two examples highlighting the relational mechanisms that determine these processes. These examples are from the scientific register and the experiential register (Lièvre 2016).

20.3.1. *An example of the acquisition of scientific knowledge during the preparation for a polar expedition*

During the preparation for the complete Antarctic ski crossing he made in 1997–1998, the explorer Alain Hubert was confronted with a crucial question. The weight and volume of the food he had to carry independently, and drag in his pulka, with him during this three-month crossing, was at first glance excessive (Hubert 2003). While this question ate away at him, he spent an evening in a bar near his home with an acquaintance, Philippe L., an agronomy researcher on livestock systems. They drank beer, and discussed more or less with humor the pemmican that Hubert ingested on his expeditions. During the evening, after A. Hubert had reported the problem to him, Philippe L. reacted by proposing that he study the feeding of his expedition as he studied that of cattle! Indeed, as a researcher, he had at his disposal an experimental stable in which he had all the necessary equipment to study a given type of feeding according to the energy needs required for an animal. … And then it was the trigger, as A. Hubert sums it up: "As the beers lined up and we redesigned the world, I began to like this image: By the way, weren't we going to look like beasts of burden for three months? So why not eat like animals: always the same thing (kinds of granules) and according to needs?" (Hubert 2003, p. 49). It was access to this scientific knowledge that allowed this explorer to solve one of the main problems he was facing, and to ensure the success of his expedition.

20.3.2. *An example of experiential learning: the crossing of Spitsbergen by a team of young students with little experience*

In the second example, as part of their annual project, a group of students from a Parisian engineering school decided to set up an expedition consisting of crossing Spitsbergen, an island located in the Arctic in Norway. Among them, Joël, fascinated by travel, took charge of the expedition. Unfamiliar with this type of environment, they knew that the preparation phase was crucial. Among the various tasks to be carried out, Joël and his teammates were well-aware of the need for a minimum period of learning with specialists in the polar terrain – that they sought all express they searched high and low for over. In search of connections, a discussion with his father, military at the French Ministry of the Interior informed him of the existence of the GMHM (*Groupe militaire de haute montagne*) in Chamonix. This military platoon is considered one of the best teams for polar expeditions. He then tried to contact them, and eventually joined the platoon captain to explain his request. Three days after this first call, the captain received a complete file on their polar expedition project with details of their application for an apprenticeship. The captain appreciated the meticulousness of their preparation and 'their reactivity, and found in the project's values those he defended at the GMHM: to undertaking for learning, facing challenges to surpass oneself and to succeed collectively. When

asked after the expedition, he confessed that it was this values closeness to these young adventurers that created the bond that began with these young people and decided him to engage in their learning. He organized a five-day program in the high mountains of Chamonix, where students lived a great time of transfer experience, the foundation of the success of their project for which this learning was decisive (Lecoutre and Lièvre 2010).

Today, any project team is obliged to mobilize actors who are very far beyond themselves (Garel 2003), and must engage in a process of mobilizing actors without ever being sure that cooperation is achievable. The two examples presented above describe situations of knowledge acquisition made possible by the mobilization of a social relationship that agreed to respond to the solicitation.

20.4. The contributions of the two streams of research in social network theory

What is the nature of the network we mobilize during these phases of knowledge expansion? We propose to start from the two fundamental approaches in social network theory: Granovetter's (1973) founding approach on the paradoxical strength of weak ties, and Burt's approach on structural hole theory (1992). These two fundamental approaches have marked the field, and are at the origin of two well-identified research streams. They provide models for mobilizing and creating new knowledge that are relevant.

20.4.1. *The approach by distinguishing ties according to their strength (Granovetter 1973)*

Granovetter's (1973) theory is well-known. During a survey to identify the means used to find a job, he became aware of the need to separate "friends", on the one hand, and "acquaintances" on the other hand, the latter being much more often at the origin of obtaining a job. This is the starting point for distinguishing between strong and weak ties. He then proposed to define the robustness of the ties based on four criteria that would make it possible to distinguish the ties according to their strength: time, emotional intensity, level of trust and the nature of reciprocal exchanges. Strong ties characterize the dense network of relatives, family and friends, who know each other well, often interact and in which information is common to everyone. Weak ties are associated with people who are only occasionally seen and some are located in other sets of relationships with whom they provide an essential connection (a bridge according to Granovetter). Its definition also has a structural aspect, the principle of transitivity, expressing the fact that there is very little chance that two people with a strong connection to the same third

person will not have any common relationship. It is this dimension that then allowed him to show that the tie between two social circles not otherwise connected has a particular property, that of necessarily being a weak tie. In the end, Granovetter focused more on the properties of relationships, strong or weak, than on structural aspects, even if the weak tie must be a bridge to allow access to other milieus.

Granovetter then explained that the success of weak ties lies in their ability to connect us to new social milieus and thus to provide richer, more varied information, which does not come to us spontaneously, and different from that to which we usually have access. In other words, if I solicit strong ties, they respond, but I learn little new knowledge. And if I solicit weak ties, I have no guarantee of an answer, but I go outside my usual milieu, and I can access new knowledge that I did not have access to before. In the first case, it is a question of knowledge that is already known and available internally, within its cluster, in the milieu usually frequented, composed mainly of strong ties. In the second case, seeking out externally knowledge that is not available goes through weak ties, which is consistent with the process of knowledge expansion.

Following Granovetter, many works based on this distinction have been undertaken (Lecoutre and Lièvre 2010). From the point of view of knowledge management, we have identified some of them. First, in their 2012 comparative analysis, Phelps *et al.* show that most research using the distinction between strong and weak ties concludes that, compared to weak ties, strong interpersonal ties are more effective in promoting knowledge transfer and learning. Thus, for Ferrary (1999), who was interested in the activity of bank advisors, the construction of a formal, objective knowledge based on a scoring grid that is supposed to define the level of risk during a bank transaction does not require the bank advisor to create a particular relationship with their client, who maintains this contact in a purely commercial relationship. But Ferrary shows that this is less efficient than building a more informal knowledge about the client, resulting from an interpersonal relationship being created, and much better guaranteeing the trust necessary for the advisor's activity. It is the emerging tie between the advisor and the client that makes it possible to access more subjective, tacit, and efficient knowledge. For Dibiaggio and Ferrary (2003), strong ties and weak ties are complementary for knowledge creation and dissemination. Strong ties are at the origin of knowledge production, through the dense interactions they generate. On the other hand, weak ties are crucial for the dissemination of knowledge that would otherwise remain locked in their circle of origin. The authors point out, however, that effective dissemination presupposes a certain proximity, and particularly a common practice based on the recognition of a shared interest between the interacting parties.

These two points of view share the common view that access to new knowledge requires weak ties, consistent with Granovetter's approach. However, Hansen (1999,

2002) refines this approach, contradicting it in part. He studied the process of research and knowledge transfer between R&D units within large companies. He showed that weak ties are effective in locating knowledge elements in other units, but that they can only transfer it if the knowledge exchanged is relatively common and codified. When the knowledge sought is tacit and complex, weak ties do not allow for its easy transfer and limit the requesting unit's ability to absorb this new knowledge. Thus, weak interunit ties help project teams to locate relevant knowledge, and accelerate project implementation, but sharing tacit and complex knowledge will require strong ties instead.

Finally, Perry-Smith (2006) looked at the creativity of researchers and showed that weak ties bring unexpected value to the creation of new knowledge, going beyond structural effects alone. These weak ties when they are numerous would have a positive effect, while surrounding oneself only with strong ties would be a source of conformity and less creativity for researchers.

20.4.2. *The structural approach*

Burt (1992, 2005) developed a theory of social capital based on the observation that social structure has "structural holes", in other words, the absence of relationships between social circles poorly connected, and that it may be strategically interesting for an actor to become the tie between these two circles. He took up the idea of a bridge between two poorly connected clusters, but abandoned any reference to the degree of strength of individuals' ties to retain only their position in the network structure. The people in a position to be the only entry point into a cluster are brokers. The more these brokers have non-redundant ties, i.e. connections to different environments that are not connected, the more they benefit in terms of power, control and access to new information. We can schematically consider three individuals, ego, A and B, and the contacts of A and B. If A and B's contacts are the same, A and B will give access to the same information. A structural hole therefore separates two or more non-redundant contacts. This approach has generated a lot of work and initiated the so-called structural approach (SNA, Social Network Analysis). It focuses only on the structural properties of an actor's network, and ignores the specific characteristics of the ties, their nature and history. The actors' game is purely strategic and intentional, and is based on the recognition of the potential benefit of connecting two separate social circles.

From the point of view of knowledge management, this approach emphasizes the strategic importance of having a very open network that allows access to new information and knowledge, which means being in a position to control "structural holes", thus being connected to brokers in your network, or even being a broker yourself. Among the most important works in this field, some thus establish the idea

that having many ties outside the cluster to which one belongs – its degree of openness – facilitates problem solving (Krackhardt and Stern 1988). Burt himself explored this path in research on the psychosocial motives of "good ideas" (2004). He showed that when you are connected to different environments, you are more creative in terms of good ideas, because, on the one hand, you are more familiar with alternative ways of thinking that provide more options and allow original syntheses, and, on the other hand, it is easier for you to promote your ideas to have them recognized as valid and to have them accepted. Similarly, Cowan *et al.* (2003) examined the structural properties of a global network of business cooperation by showing that it is the connection between disjointed subclusters within the global network that best ensures the dissemination of knowledge, especially when it is a young industry resulting from recent innovations (Cowan and Jonard 2007). Perry-Smith also tested the idea that the weak tie that stimulates creativity would have this effect because it would connect different social circles (Perry-Smith 2006). She thus showed that the structural property of these weak ties certainly partly explains the creativity of the researchers studied, but that it is far from being sufficient to account for their creative capacities, opening a first gap in the work developed within the current structural approach.

20.5. Feedback and questions on these approaches

What can we learn from this first overview? We discuss the issues raised by these approaches in three stages, concerning the nature of the tie considered, the type of knowledge mobilized and the process of accessing it.

20.5.1. *First question: the nature of the tie*

Following Perry-Smith (2006), beyond the possible role of weak ties as a means of accessing unconnected exchange partners and therefore diverse knowledge, it is the very nature of the tie, as a weak tie, that would be largely responsible for this increased creativity: the weak tie would have an effect on creativity by itself. It thus paves the way for a first critique of the classical structural approach. The common point of view in this approach is indeed to consider the question of knowledge almost exclusively from the angle of a "diffusion/transmission" process, through relational networks that are themselves considered neutral "pipes" and that only need to be connected to ensure effective circulation. The conception of knowledge, whatever it may be, is then that of a "package", circulating unimpeded through these pipes, regardless of their nature. Perry-Smith's results show that, in the context of research on creativity, i.e. the production of new ideas or knowledge, the structural approach cannot take into account the phenomena observed.

This emphasis on the effect of the link itself then questions its characteristics, and the nature of the process observed. Here, we see a shift between diffusion and creation of knowledge: everything happens as if creation and diffusion occur in the same movement, which can be the case if we consider that the search for new knowledge is similar to a creation of new knowledge for the seeker, in the context of an interaction with a person whose relevance of knowledge has been identified. It would then be more a question of co-creation, absorption, or even re-creation, corresponding to an interactive conception involving the nature of the tie that emerges between two people, who produce in the context of their interaction the knowledge useful to one of them.

20.5.2. *Second question: the nature of knowledge*

A second level of criticism is provided by Borgatti and Cross (2003), this time on the nature of the knowledge involved in these processes. While still subscribing to the structural approach, these authors question the knowledge research model. Their starting point is familiar in the field of KM, since they criticize the notion of knowledge as a good external to individuals, fungible and objectively exchangeable. Knowledge can no longer be considered only as stabilized, clarified, codified and accessible at any time (wiki model), but also largely tacit, integrated into individuals' practical experience and routines, and specific to the situation under consideration. They then suggest the idea of transactive knowledge, in which knowledge can only be sought, identified, mobilized, learned, or even created through interactions between individuals.

In a second step, they propose a research model based on four preconditions for knowledge acquisition. If X is looking for a type of knowledge, four questions will arise:

– "knowledge": what does X know about Y's expertise?

– "value": does X positively evaluate Y's knowledge?

– "access": is X in a position to access Y and its knowledge resources at the appropriate time?

– "cost": does X think that Y's approach would be too socially "risky"?

Testing of the model leads to the validation of the first three conditions, and to the exclusion of the one concerning the social cost of access to a person holding knowledge. Everything therefore happens as if X were in a situation of all or nothing: he has already identified Y as an expert and a possible source of knowledge, he already knows what he is looking for to be able to identify the nature

of Y's expertise and assess the interest for him, and he is able to assess in advance the possibility of accessing Y in a timely manner without taking too many risks.

20.5.3. *Third question: the nature of the process*

We propose here a third criticism, based on the nature of the process of knowledge expansion. Borgatti and Cross' (2003) approach has the merit of clearly resituating the crucial role of relational networks in a process of knowledge expansion, since the notion of knowledge is extended to its tacit dimensions and the importance of interindividual interactions. On the other hand, the model they propose quickly finds its limits. This model may seem relevant in traditional knowledge-seeking situations, but it is not the same in knowledge expansion situations, which are uncertain by nature (Lièvre 2016), and therefore closer to the creation of new knowledge, with previously unknown people. Three limits can be identified here: the omniscient actor, a non-temporal approach, and a cooperation between actors that goes without saying.

The first limit is classical, and refers to a conception of the actor as an omniscient being acting only in full knowledge of the facts. In all cases, this model presupposes an initial knowledge of (1) what is being sought and (2) who owns it. Their formal model actually abandons part of what they announce. It does not provide an account of how the acquisition of new knowledge is achieved in practice. In this case – the process of expanding knowledge in an innovation context – this approach ignores the exploration, emergency or uncertain situations that characterize it and in which what we are looking for is not known or knowable in advance, nor do we really know who we are looking for. This is the case, for example, of A. Hubert and his meeting with the agronomist who provided him with both the scientific knowledge and the person who possessed it; in example 2, Joel, on the other hand, had an idea of what he was looking for, but not who he was looking for. In terms of the second limit, the approach is non-temporal, without any reference to time, to a history, to an evolving process that lasts. The expansion of knowledge is part of an exploration situation in which what is sought as much as the person who will prove to be the expert on the situation is defined and clarified during the research process, sometimes in a contingent way (Bootz *et al.* 2015). Relevance, the cost of accessing new knowledge and the challenge of accessing these resources at the right time, etc., are rarely easy to assess from the outset of the research, and their discovery is concomitant to the action.

The third limitation therefore refers to the idea that any relationship between actors is the basis for a cooperation that goes without saying: it is sufficient for two actors to be in contact for any flow of exchange of services, information or knowledge between them to be automatic. This is the position of the structural

approach, in which the question of why individuals exchange does not arise. This approach is based on the "pipe" principle, or automatic flow, which Borgatti in a more recent work (Borgatti and Halgin 2011) calls the pipe model. The authors distinguish this approach from that of considering interindividual relationships, no longer by their abstract characteristic as edges in a graph or pipes of a plumbing system, but as ties between people defined by their content, the bond model.

For this approach, what counts is the nature of the tie, what connects two people, what bases their relationship, whether it is a proximity (identity) or a shared interest (instrumental), that is, why two people are connected, in a given situation. In this context, the question of cooperation in access to new knowledge, i.e. the reason why when X asks Y, he answers, takes on its full meaning. In terms of Borgatti and Cross's (2003) research model, I may very well have identified Y's expertise, positively assessed his knowledge and be in a position to access him and his resources at the right time, but without any guarantee that Y will respond to my request. We develop this point in the following section.

20.6. The question of the nature of ties the notion of a "potentially strong" weak tie

Having seen the limitations of the structural approach, we propose to revisit the question of the role of the social network in the process of knowledge expansion from the perspective of the nature of the ties involved in such a process. We therefore encounter the bond model approach according to the distinction made by Borgatti and Halgin (2011) in which it is the nature of the ties that counts, as Perry-Smith (2006) suggests the importance of weak ties by themselves in researchers' creativity.

In his founding work of 1973 on the distinction between strong and weak ties, Granovetter showed that paradoxically it is weak ties that most often give access to a job insofar as they provide new information, far from one's usual environment. Similarly, many works converge on the idea that weak ties would give access to new knowledge, new fields, far from the usual spheres of life, and to good ideas, more creativity, etc. This is the argument for the superior effect of social structure on motivation: access to new spaces via weak ties automatically gives access to new knowledge, even if according to Granovetter's definition, these weak ties would *a priori* have no reason to cooperate. We have identified two criticisms above: some studies show that paradoxically weak ties are certainly useful for identifying knowledge far from its base, but only allow the transfer of simple knowledge, without much scope, while others show an effect of the network itself that would be distinct from structural effects.

According to Granovetter's definition (1973, 1982, 1995), it is easy to understand why strong ties, which are people close to us, exchange and accept to help us by nature, because of identity proximity; they may even oblige themselves to cooperate when it is not relevant. On the other hand, how can we ensure cooperation with an actor we do not know or only know a little when we are looking for resources or knowledge far from the familiar worlds? Of course, weak ties allow access to resources located in clusters, remote social spaces, characteristic of a process of knowledge expansion, but why do these people with whom we come in contact as weak ties respond?

It is the question of the nature of the weak tie that is being asked here. In recent work (Lecoutre and Lièvre 2010, 2015), we have taken up in depth how Granovetter defines the distinction between strong and weak ties. We have relied on the long philosophical (Aristotle) and sociological (Tönnies, Durkheim, etc.) tradition of distinguishing between the register of community and that of society (Schrecker 2006), itself taken up in Granovetter's latest work (Granovetter 2017, pp. 21–26). We thus recombined the four criteria he used, showing that the time criterion was not necessary, that the criteria of emotional intensity and trust level could be combined into a single criterion of identity proximity and that the last criterion concerning the nature of reciprocal exchanges characterized the instrumental side of interindividual relations. This recomposition of the distinction strong tie/weak tie allows us to operate a different partition from that of Granovetter:

– the strong tie is characterized by a strong identity proximity, as well as a strong intensity of instrumental exchanges, in this respect no different to Granovetter;

– on the other hand, the category of weak ties is divided into two: on the one hand, weak ties on the two criteria of identity proximity and instrumental exchange and, on the other hand, those that would be weak are based on only one of the two criteria, and therefore asymmetrically strong on the other.

We call this second type of weak tie the *potentially strong weak tie*. This type of link is the only one that allows the initiation of a cooperative relationship between two people who come into contact: soliciting a person with whom the tie would be weak both on the identity side of the relationship (no common value system, no feeling of belonging to the same group, etc.) and on the instrumental side (no possibility of exchange) is a dead end. Our relational stories are full of these impasses, but the *a posteriori* account of the success of an action generally only retains those relationships that have actually worked and led to the success of the action in question, by removing all traces of attempts that have not been successful. We thus defend the idea that the weak ties that are at the source of so many advantages in the literature are in fact weak ties that are potentially strong: if the contact worked, it is because one of the two dimensions, identity or instrumental,

was potentially strong in the relationship that is being drafted, allowing this relationship to live and develop its history.

In the field of knowledge management, and more particularly the process of knowledge expansion in innovative exploration projects, the role of weak ties is then presented in a new light. Not all weak ties are of equal value in this quest for new knowledge. If this quest requires opening up to new spaces and meeting new people by opening up the field of possibilities, the characterization of potentially strong weak ties makes it possible to better reflect the process that is taking place. In the two examples presented at the beginning of this paper, the entry into the relationship begins with the recognition of an identity proximity: Hubert accessed via a friendly acquaintance (identity proximity) to scientific knowledge that is decisive for the continuation of his project; Joël accessed via the recognition of an identity proximity (the GMHM captain is in his value system) experimental knowledge that was crucial for the success of their expedition project. But one can also very well imagine a beginning of a relationship based on the identification of a possibility of instrumental exchange between the two protagonists of a contact based on the perception of a shared interest in the relationship that is being drafted.

Our approach thus makes it possible, for example, to revisit the paradox raised by Hansen's (1999) observation. Following on from Hansen, the transmission and appropriation of complex, tacit knowledge, etc., requires a certain level of proximity or the sharing of common expertise in a given field, which is rather the prerogative of strong ties. Weak ties, on the other hand, could allow the identification or location of new knowledge resources, but without the possibility of transmission or appropriation. The paradox is that when it comes to strong ties, then what is circulating is common knowledge, without research or access problems. However, if we consider that the weak tie requested is a weak tie potentially strong, then any action of transmission/appropriation becomes possible.

20.7. Conclusion: relational network and process of knowledge expansion

We will conclude with two points. First, the contribution of the social network to understanding the process of knowledge expansion is mainly that of the role of the weak tie. As soon as it is possible to distinguish the weak tie with no future from the weak tie potentially strong, three contributions seem to emerge:

– location/cooperation: weak tie property allows contact to be made with resource holders far from familiar spheres, and the fact that it is potentially strong also guarantees the possibility of cooperation from them;

– *ad hoc* delay: here again, its quality as a weak tie potentially strong makes it possible to ensure rapid or timely access to the identified resources;

– finally, it makes it possible to acquire or transmit complex, tacit and relevant knowledge for the action envisaged.

The second point sets out questions outlined in this chapter that remain unresolved regarding the nature of the knowledge being accessed in a process of knowledge expansion. It is relatively easy to design the circulation or access to explicit, objective knowledge external to individuals as part of a structural approach to the network (package model circulating in pipes). However, this is not the case when one tries to describe a process of knowledge expansion in which knowledge is *a priori* in a state of disruption, radically new or even inconceivable at least initially in relation to the cognitive environment of the person who initiates this process. Moreover, since we consider that this knowledge is largely tacit and only finds its relevance according to a given context or situation, its appropriation requires the development of a tie between people who exchange, have a common practice for an effective transmission, as for example in the functioning of communities of practice (Cohendet *et al.* 2003). Everything then happens as if the knowledge did not exist before the relationship was established: it would rather be a process of co-construction, which could be translated as "I interact so I construct knowledge". Is it then a question of accessing, acquiring, exchanging, transmitting, appropriating, absorbing... or (re)creating knowledge?

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21

The Crowd and the Expansion of Knowledge

21.1. Introduction

The framework of this chapter is the question of expanding knowledge in a business environment under extreme stress. In this context, companies are subject to a double uncertainty. The first identified case is a classic problem-solving issue, but whose solutions are unknown for the company, but also by the members of its ecosystem. The second case is that companies, in order to stand out from the competition, will seek to bring about the emergence of disruptive ecosystems. These two cases are exploration problems in the sense of March (1991), but to differentiate themselves from their competitors, some companies will try to find new and original resources. In an open innovation context, one such solution is the use of crowds (Pénin *et al.* (2013).

The crowd is not spontaneously associated with the idea of knowledge expansion. The crowd is rarely likened to an expert. On the contrary, the crowd is in common opinion associated with a mass phenomenon that dehumanizes individuals and leads to irrational behavior. Nietzsche, among others, criticized the gregarious instincts of humanity. These gregarious behaviors are also generally denounced by authors in economics and management. First, we will look at the negative approaches of the crowd. In seeking to understand the mechanisms that lead to this dark vision, we will try to show that these approaches have real limits, and we will present the conditions for a new approach to crowds. Then we will look at crowdsourcing as an practice which recently emerged. We will seek to characterize this practice in terms of the need for companies to expand their knowledge.

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21.2. The crowds and knowledge

21.2.1. *The crowd, the company and the market*

The criticism of gregarious behavior is old in economics. Keynes (1936) recalls the risk of this behavior in his famous example of the beauty contest; here is what the author writes:

> "These contests organized by newspapers where participants have to choose the six prettiest faces from a hundred or so photographs, the prize being awarded to the one whose preferences are closest to the average selection made by all competitors. Each competitor must therefore choose not the faces that he himself considers the most beautiful, but those that he considers most likely to win the vote of the other competitors, who all examine the problem from the same angle. It is not a question of choosing the faces that, as far as one can judge, are really the prettiest or even those that the average public will really consider as such. At the third stage, where we have already reached, we use our abilities to discover the idea that the average opinion will be made in advance of our own judgment."

This example illustrates a situation where agents no longer seek to invest in the intrinsic value of an asset (particularly financial security), but seek to guess the behavior of other agents in the market. The consequence is irrational behavior that can lead to the development of speculative bubbles. Herding behavior, therefore, becomes not only absurd, but also dangerous. Many more recent works take Keynes' early developments further, including work on herd behaviors (Bikhchandani *et al.* 1992) and more recently on speculative crowds (Orléan 2001).

21.2.2. *The factors of crowd irrationality*

But this vision of an irrational, even dangerous crowd goes beyond the economic analysis of behavioral finance; it is very widely accepted. Moreover, the "crowd" itself makes it its own; Wikipedia is the archetype of production by the "crowd". And here is how this collaborative encyclopedia characterizes it (in January 2017):

> "The crowd shares with the group the idea of geographical proximity and quantity of people, but also has the following attributes:
>
> – collective consciousness: the thoughts and actions of each member of a crowd are all directed toward the same goal;

> – rationality: the overall level of rationality of a crowd is generally considered lower than that of its agents".

So the crowd is not just a large number of people gathered in the same place, it also has a common goal. This collective consciousness is in contradiction with the idea of cognitive diversity necessary for the creation of knowledge. How could there be an expansion of knowledge if the crowd shares the same vision? But the second attribute is even more radical because it emphasizes that the crowd is considered inferior to the individuals who compose it. One can, therefore, legitimately wonder about the rationale for addressing the crowd for any cognitive task. This very negative view of the crowd's cognitive abilities is consistent with the popular perception that spontaneously associates the latter with Nazi mass gatherings or crowd overflows leading to the worst lynchings.

This perception of the crowd is a direct result of Gustave Le Bon's work. His work on crowd psychology is directly influenced by mass excesses during the French Revolution of 1789, a period of history closer to the author, by revolutionary episodes that shook the 19th Century, particularly during the Paris Commune. For French intellectuals, imbued with the philosophy of the Enlightenment on the emancipation of the people and the social contract, the acts of violence that accompanied the revolutionary movements were a source of questioning. Thus, Gustave Le Bon considered that the crowd has a consciousness of its own, a consciousness that is both irrational and influenceable. For him, individuals within a crowd were characterized by irresponsibility, contagion and suggestibility.

21.2.2.1. *Irresponsibility and contagion*

In a crowd, individuals are irresponsible. Anonymity is the cause of a sense of impunity that leads to a loss of inhibitions. In addition, a phenomenon of contagion means that the same passion will agitate all the members of the crowd. These two individual feelings are the cause of the irrationality and dangerousness among the crowd. This feeling of "sympathy" that characterizes the grouping of people is a phenomenon that particularly interested the 18th-Century Scottish philosophers David Hume and Adam Smith. Adam Smith (1759) defined and illustrated the phenomenon of "sympathy" as follows:

> Upon some occasions sympathy may seem to arise merely from the view of a certain emotion in another person. The passions, upon some occasions, may seem to be transfused from one man to another, instantaneously, and antecedent to any knowledge of what excited them in the person principally concerned section 6 : https://www.ibiblio.org/ml/libri/s/SmithA_MoralSentiments_p.pdf

Gabriel Tarde's imitation phenomenon takes up the same idea. The consequence for Gustave Le Bon of this phenomenon of contagion at the individual level is that the crowd develops a collective rationality of its own. It is not the sum of individual rationalities, but a different level of rationality that he calls the "mental unity of the crowds". Thus, for Le Bon, influenced by Darwinism:

> "The psychological crowd is a temporary being, formed by heterogeneous elements that for a moment have united, absolutely like the cells that constitute a living body form by their union a new being manifesting characters very different from those that each of these cells has."

By highlighting the soul of the crowd, the individual will participate in the birth of a new discipline: psychosociology. But if the crowd has a soul, or a conscience, for Gustave Le Bon, this is not particularly a source of knowledge, quite the contrary. He describes crowds as "not very good for reasoning". Thus, the crowd is not guided by reason, but by passions. Gustave Le Bon considered that the crowd has a consciousness of its own, but that it is inferior to that of the individuals who compose it, he described it as primitive. At this stage of reasoning, he considered the crowd to be literally "stupid", but not necessarily "evil".

21.2.2.2. *Suggestibility*

The individuals within the crowd lose their own rationality to subordinate by contagion to the overall rationality of the crowd. But in addition, the individuals within the crowd are particularly susceptible to being influenced by a suggestibility phenomenon. Because of the phenomenon of crowd contagion, this suggestibility will not only apply to the individuals composing it, but to the crowd as an autonomous consciousness. It is this manipulated crowd that will not only be "foolish", but will also become potentially dangerous.

Gustave Le Bon's work is strongly influenced by the development of research on hypnosis that was contemporary at the time. In particular, it was in line with the discoveries developed by the Nancy school. In contradiction with the experiments conducted at the Salpetrière by Jean Martin Charcot, Hippolyte Bernheim showed that hypnosis was not the only means of suggestion. He developed the concept of "suggestibility", which differs from hypnosis in that the subject is not asleep, but behaves in the same way.

Sigmund Freud, in his preface to the translation of Bernheim's book *De la suggestion dans l'état hypnotique et dans l'état de veille* (1884) proposes this characterization of the suggestion:

> "I would like to suggest that what distinguishes the suggestion from other kinds of psychological influence, such as a given order, or information, or instruction, is that, in the case of the suggestion, an idea is raised in another person's brain that is not examined as to its origin, but is accepted exactly as if it had formed spontaneously in that brain."

Gustave Le Bon considered that it was these mechanisms of suggestibility that allowed a charismatic leader to guide the crowd. This leader could push the crowd to adopt the most violent and absurd behaviors. In particular, he illustrated the many cases where the crowd chooses behaviors that are harmful and against the very interests of the individuals who compose them. Gustave Le Bon found many illustrations of this phenomenon in the outbursts of violence that characterized the French revolutions. But this work would also be a source of inspiration for the totalitarians of the first half of the 20th Century.

21.3. Crowds and the media

The individual mechanisms of contagion and suggestibility thus lead the crowd to behave as a whole with its own rationality. This rationality is detached from that of the individuals who make up this crowd (Elias Canetti, 1960). This mass can be manipulated by a leader through the mechanism of suggestion.

Serge Moscovici (1991) underlined the importance of the unique place to gather the crowd in Gustave Le Bon's work. For the latter, the phenomena of contagion and suggestibility can only work if the participants are physically close to each other. The development of mass media, such as newspapers, but especially that of cinema and then radio and television, will challenge the mechanisms that characterize crowds. Thus, Gabriel Tarde introduced the notion of audience that comes to oppose that of crowd by the absence of contagion phenomenon. We see that the nature of the media changes the nature of the multitude. But the audience is cognitively hardly more interesting than the crowd, because as Gabriel Tarde points out, if the contagion mechanism is dissipated, the suggestibility mechanism is strengthened. This strength of the mechanism of suggestion for the public is in the very definition that Gabriel Tarde gives of the public: "A purely spiritual community that is built through simultaneous reading and remote suggestion." The suggestion is reinforced by the mass media because the communication is monodirectional and asymmetrical. The viewer finds himself in a lower position than the one in television, unable to question it. Here again, totalitarianisms will innovate by using the mass media on a grand scale to impose their vision of the world on crowds as hypnotized.

21.4. The new visions of the crowd

Since the early 2000s, a new vision of the crowd has emerged. In his provocatively entitled book, Surowiecki (2004) proposes a direct response to Gustave Le Bon's work. He notes that the crowd is not necessarily irrational and manipulable; on the contrary, a true "wisdom of the crowds" exists. He does not question the relevance of traditional crowd analyses, but insists that the crowd is not just the behaviors described by Le Bon. The crowd is thus particularly "wise" in three fields: cognition, coordination and cooperation.

The last two points are the least original. *Coordination* is the possibility for the multitude to solve behavioral coordination problems such as traffic jams. In a tautological way, it is more relevant to coordinate with several people than alone to solve coordination problems. In the same way for *cooperation*, it is a *priori* necessary to be several to do so.

The first aspect, that of *cognition*, is much more interesting and richer: indeed, it opposes the classical vision of the crowd that has been developed in the previous part of this text. For James Surowiecki, the crowd potentially has cognitive abilities superior to the best of the experts. To illustrate this potential, he uses the famous anecdote by statistician Francis Galton. He observed a competition in which the weight of an ox is guessed just by looking at the live animal. Galton noted that if we take the median of the participants' bets, we obtain a result very close to the real weight. Statistically this result will be better than the result proposed by an expert, while in the game anyone can play. This result could be repeated with many other examples, such as betting on the number of balls contained in a jar. This result is particularly interesting in that it seems close to the example of the Keynes beauty contest. However, the conclusions drawn about the cognitive potential of the crowd are diametrically opposed.

If the result is also opposite, it is because there are good conditions for crowd cognition (Surowiecki 2004):

– cognitive diversity: each individual must be able to possess his or her own truth, even if it is only a marginal interpretation of known facts;

– independence: the opinion of each individual must be able to be expressed without being influenced by the opinion of others. Indeed, without this condition of independence, the crowd would very quickly lose its cognitive diversity;

– decentralization: decentralization is beneficial, since it implies that a host of independent individuals can organize themselves to produce collective solutions.

The major difference between Keynes' example and Galton's example is that in the first case the principle of independence was not respected at all. The mechanism

highlighted by Keynes is based on the principle of imitation. The player does not bet according to their own rationality, their own choice (choosing the portraits they find the nicest), but according to the anticipation of the supposed rationalities of others (choosing the portraits that I suppose others will like).

If Surowiecki's good conditions seem logical to allow cognition, they also appear to contradict the very notion of a crowd. Indeed, how can we guarantee cognitive diversity, or independence, when research on social psychology has very clearly shown the emergence of contagion or suggestion as soon as individuals come together? Moreover, can we still talk about a crowd in a gathering that allows diversity and independence?

21.5. Internet: towards a wise crowd?

In this chapter, we have chosen to question the potential of the crowd as a cognitive resource. Thus, quite logically, we were interested in the characteristics of the crowd as demonstrated by psychosociology. But if we return to the general definition of the crowd, we realize that this term has two similar meanings, but with quite different characteristics. Here is how the famous French Larousse dictionary defines the crowd:

– "a large number of... :

– multitude of people gathered in the same place:

The second acceptance corresponds to the notion of crowd as included in Gustave Le Bon's further work. This "mass" crowd is the one that has most interested philosophers, sociologists, even giving rise to a new discipline, psychosociology. At the heart of this vision of the crowd is the question of rationality or non-rationality; it is for this reason that we have developed this approach extensively in the first part of this chapter. However, the first acceptance implies a quite different vision of the crowd, especially in its potential as a cognitive resource. Indeed, having access to numerous individuals can also be a source of diversity and heterogeneity

Taking this dual view of the crowd, is it possible to overcome the contagion and suggestion mechanisms highlighted by Gustave Le Bon, David Hume and Adam Smith? Authors like Gabriel Tarde have put a lot of hope in the development of mass media to hope for the emergence of a crowd not subject to the phenomena of contagion or suggestion. But these hopes were largely dashed.

The development and democratization of the Internet has changed the conditions for people's connections. Individuals can communicate with each other on a massive

scale without being physically close. In addition, unlike mass media that promote suggestibility, through one-way communication, the Internet facilitates multidirectional communication. The Internet makes it possible to connect individuals while guaranteeing everyone's cognitive diversity and, above all, their independence. Each Internet user can use their own rationality independently, without being constrained by a phenomenon of contagion. The crowd is no longer a "mass", but a *multitude*. As early as 1994, Pierre Levy's pioneering work on collective intelligence noted that because of the Internet, we "can coordinate in real time intelligences distributed everywhere". Ewans and Wurster (2000) show that the Internet makes it possible to overcome the trade-off that characterized the traditional -information economy between reachness and richness of information.

Thus, due to the Internet, the right conditions for the wisdom of the crowd are made possible. It is important to point out that it is by no means said here that the Internet makes the conditions necessary, but that they are only possible is in itself a major development. Thus, the crowd has the potential to foster the expansion of knowledge. The rest of this chapter will propose examples of mechanisms to promote and, above all, to capture the cognitive capacities of the multitude.

21.6. Crowds and knowledge expansion: crowdsourcing

The emergene of Internet and digital technology has led to the emergence of new ways of relating multitudes and organizations. For companies in particular, the crowd tends to become a resource through crowdsourcing practices. This phenomenon, first conceptualized by Jeff Howe in 2006, is unique in that it involves connecting the company with the crowd. What type of crowd is it and how can the multitude contribute to the process of knowledge expansion?

21.6.1. *The different types of crowdsourcing*

The concept of crowdsourcing was characterized by Howe in the journal *Wired*. Generally speaking, it is a matter for a company or an organization to have a task performed by a group of anonymous people using the Internet. Crowdsourcing thus connects several types of actors:

– the company or organization that outsources a certain task. This actor is sometimes called a seeker (or requester); it is they who decide to implement crowdsourcing, particularly according to economic criteria (cost of performing the task, associated risk, etc.);

– the crowd. A set of contributors initially unknown by the seeker, and whose number (cardinal) as well as their boundaries are not defined in advance. In its initial

version, crowdsourcing does not encourage interaction within the crowd, but rather aims to connect the company with a host of potential contributors. It is therefore very clearly a vision of the crowd in the sense of "multitude of actors". We find the "good" conditions for the wisdom of the crowd as we recalled earlier.

Crowdsourcing naturally applies to the production of dematerialized tasks, such as problem solving or graphic design. A lot of work has been done to characterize the different forms of crowdsourcing. Thus, in Schenk and Guittard (2012), we propose a typology of crowdsourcing practices in three classes based on the cognitive nature of the expected result.

21.6.1.1. *Crowdsourcing of routine tasks*

In the economic world, Alphabet (Google) is probably the company that mobilizes crowdsourcing the most in its value creation process. For example, the Google search engine uses the frequency of visits to websites to rank these sites, i.e. their order of appearance in search results. In other words, visiting a website is a vote for that site. The sites that get the most votes are given a higher ranking. It is indeed a form of crowdsourcing and then it is the Internet users who feed, through their visiting behavior on the Internet, the ranking process.

Crowdsourcing of routine tasks is also used by the reCaptcha application, which provides an antibot control service. This service allows website administrators to protect themselves from attacks or invasions by virtual agents. Indeed, reCaptcha offers a test system that allows you to verify that actions on websites (search, registration as a user) are not the work of "virtual robots", but of human beings. This test generally uses a character recognition device (Figure 21.1). The Internet user is asked to recognize two words. One of these words is known by the system, while the other is a word poorly scanned by character recognition software (OCR software) and needs to be identified.

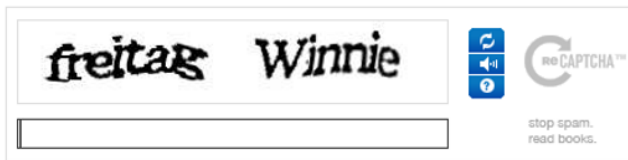

Figure 21.1. *reCaptcha window*

This system is of obvious interest to website administrators, but the originality lies above all for those involved in the digitization of archives (e.g. Google). Indeed, the process of digitizing archives involves a semantic analysis of documents, which requires text recognition. Unfortunately, character recognition software is sometimes

defective and does not always recognize the characters and terms used. Through reCaptcha, the company Alphabet (owner of reCaptcha) has the work of word recognition performed by the "little hands" of Internet users, free of charge and without any real compensation.

Crowdsourcing of routine tasks is thus used when there is the possibility of performing simple tasks by a multitude of actors. These different crowdsourcing applications for performing routine tasks have similarities:

– contributors bring elements that, taken individually, have a low added value, but whose aggregation within a global system brings a high added value;

– therefore, it is not a question of selecting a particularly relevant contribution, but of integrating the contributions. Crowdsourcing is called "integrative";

– contributors are not or poorly paid for their contributions;

– one of the challenges for the company is to ensure the reliability or veracity of contributions. Artificial intelligence algorithms play an important role in validating contributions and controlling risk.

Thus, crowdsourcing of routine tasks does not present a significant cognitive challenge. The skills required of the crowd are individually elementary; it is in the aggregation of these data that the value and interest of such a practice lies. This type of crowdsourcing is part of the more general phenomenon of Big Data, which aims to enhance the value of massively produced data. If it promotes the expansion of knowledge for the firm, it is only indirectly and mainly for marketing purposes to improve market knowledge. It promotes production, but does not directly intervene in the innovation process. This type corresponds to data crowdsourcing.

21.6.1.2. *Crowdsourcing of creative tasks*

The performance of creative tasks is another common form of crowdsourcing. Platforms such as Crowdspring, Creads, eYeka and 99designs thus have the function of bringing together applicants and service providers to create logos, slogans, graphic designs, etc.

These platforms act as an intermediary between companies that wish to outsource the performance of tasks with an artistic dimension, and service providers of various kinds: design professionals, students, amateurs, etc. The approach implemented in these systems is sequential in nature (Figure 21.2).

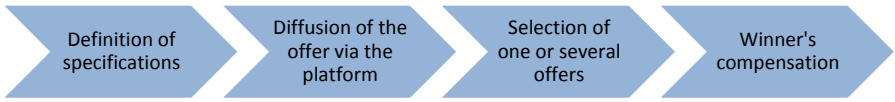
Definition of specifications
Diffusion of the offer via the platform
Selection of one or several offers
Winner's compensation

Figure 21.2. *Creative crowdsourcing process*

In this type of crowdsourcing, the company solicits the crowd for individual creativity that members can share. The company is thus seeking number and diversity, the underlying assumption being that the multiplicity and independence of the contributions is likely to increase the probability of the applicant's satisfaction. This type of crowdsourcing is the closest to traditional outsourcing, the particularity being that the company addresses anonymous rather than identified companies. The questions usually asked are of course the respect of contractual commitments, particularly with regard to intellectual property, but also the competition between traditional players with a presence in the market and amateurs, in a potentially "unfair" context. Indeed, professionals (in design and creation) are subject to regulatory and legislative constraints that generate costs that "amateurs" do not bear.

This form of crowdsourcing results in sometimes significant remuneration, even if it is lower than that of a professional service provider or an internal development. Thus, the Lego company mobilizes the crowd for the design of "Lego boxes" through its Lego Ideas platform (Schenk *et al.* 2017). In another area, Parkeon, a company specializing in the design and construction of parking meters, has implemented a creative crowdsourcing competition to develop new service opportunities associated with their product (Schenk and Guittard 2016).

Through these different concrete examples, crowdsourcing of creative tasks presents the following cognitive properties:

– contributors mobilize their creativity and individual skills for creations that, individually, can have value for the company and its customers. Thus, the contributors are paid;

– the key challenges for the company are to select contributions and ensure that contractual clauses are properly respected. The crowd can be mobilized in the selection phase through crowdvoting devices. This crowdsourcing is first of all selective;

– in addition to this selection, the challenge for the company is also to be able to integrate concepts and ideas forged outside its borders.

In this type of crowdsourcing, the company seeks to increase its knowledge, no longer by seeking to integrate new data, but ideas. In terms of knowledge expansion, we can talk about a crowdsourcing of ideas.

21.6.1.3. *Crowdsourcing of complex tasks*

The last category of crowdsourcing concerns more specifically the innovation process. During an innovation process, it is not uncommon for the company to encounter a particular problem that constitutes a critical obstacle to the progress of the project; usually, problem-solving was done by mobilizing internal R&D teams or by using service providers.

Since 2001, the InnoCentive platform has been offering Internet contact between seekers and solvers, enabling companies to use the crowd's intelligence to solve problems. InnoCentive's fields of application are vast, covering the fields of space, pharmaceuticals, chemistry, computer science and artificial intelligence, etc. Through InnoCentive, companies can therefore outsource part of their research and development activities. In particular, this system allows the company to seek solutions far from its usual field of expertise and to avoid the incremental trap of exploring scientific fields that are already known. Ahuah and Tucci (2012) talk about remote search and show under which conditions crowdsourcing is relevant for this activity.

In addition to the question of contractual clauses, the ability of the requesting company to formulate the problem it faces in a sufficiently detailed and precise manner and its ability to select and integrate the solutions proposed by the crowd are conditions for the success of this crowdsourcing. Crowdsourcing complex tasks is not a miracle solution that would completely replace internal R&D. Maintaining strong internal R&D is necessary for the construction of absorption capacities and the implementation of crowdsourcing solutions. It is, therefore, not surprising to note that among InnoCentive's "customers" are companies that are highly R&D intensive, such as Roche, Sanofi, Suez and NASA.

Crowdsourcing complex tasks has some pitfalls. First of all, there is sometimes a tendency within R&D teams to reject ideas that come from outside. This "Not Invented Here" syndrome (Guittard *et al.* 2015) is a real obstacle to the implementation of crowdsourcing solutions. Moreover, by disclosing on the Internet the problems it faces, a company is likely to provide information to its competitors. This is why crowdsourcing platforms such as InnoCentive offer a support service to corporate clients, particularly regarding the drafting of contractual clauses and the formulation of the problem. In addition, this type of crowdsourcing is used by companies when they are confronted with problems that they do not control; there are, therefore, real challenges for them in formulating the question and especially in integrating the solution (Benin and Burger-Helmchen 2012).

In summary, the main features of crowdsourcing complex tasks are as follows:

– companies are seeking to benefit from advanced skills in potentially very diverse fields. The contributions are knowledge-based and have real added value in that they remove scientific and technical obstacles in the innovation process:

- this crowdsourcing is selective and on InnoCentive, the remuneration for the winner generally ranges between $10,000 and $50,000;

- in addition to compliance with contractual clauses, the key challenges for the company are the selection among contributions and the integration of external knowledge into the internal innovation process;

– the company is not only looking for data or ideas, but also for solutions to a complex problem that will allow it to innovate. The implementation of solutions generates a process of knowledge expansion. This modality, therefore, corresponds to a crowdsourcing of knowledge.

21.6.2. *Crowdsourcing and knowledge expansion*

With crowdsourcing, the crowd can be considered as a "pool of resources" available in a flexible and cost-effective way. The reading grid depending on the nature of the tasks assigned to the crowd can address the issue of knowledge expansion related to crowdsourcing. If we link this typology of crowdsourcing practices to the alder of knowledge expansion, we obtain three types of crowdsourcing: data crowdsourcing, idea crowdsourcing and knowledge crowdsourcing.

The DIKW model (see, for example, Ackoff 1989) is enlightening to understand the relationship between crowdsourcing and knowledge expansion.

Figure 21.3. *The DIKW model*

Crowdsourcing of routine tasks is aimed at the acquisition of data and information, which are the primary variables of the DIKW model. It is only after processing and exploitation that these bricks are transformed into knowledge. Thus, it can be said that this crowdsourcing makes it possible to feed the process of knowledge expansion by providing external resources in number and at a lower cost. But the expansion of knowledge is in the transition between information and

knowledge, which is done internally within the company, so the crowd is not the actor of the expansion of knowledge, but simply the source of the data. In idea crowdsourcing, transfer refers to the copyright of a drawing, graphic, etc. We are in the "simple" outsourcing field and for the client company, there is no initial learning phenomenon. Thus, the impact in terms of knowledge expansion seems limited. It is not a question of expanding knowledge, but of seeking ideas from within the crowd.

Finally, it is in the case of crowdsourcing complex tasks that the expansion of knowledge seems to be the most important. This activity is not limited to simple outsourcing, but involves translation, formulation and integration of external knowledge. On the one hand, the crowd can be seen as a pool of resources and, on the other hand, the company involved in the process acquires new scientific and technological knowledge, while improving its ability to formulate problems. This is why we can talk about a form of co-creation between the crowd and the client company. Crowdsourcing of complex tasks is not limited to a transfer of knowledge to the company, but also feeds into the learning process that allows the company to absorb external knowledge (Figure 21.4). It therefore seems to be more a source of knowledge expansion for the company than the other two forms of crowdsourcing.

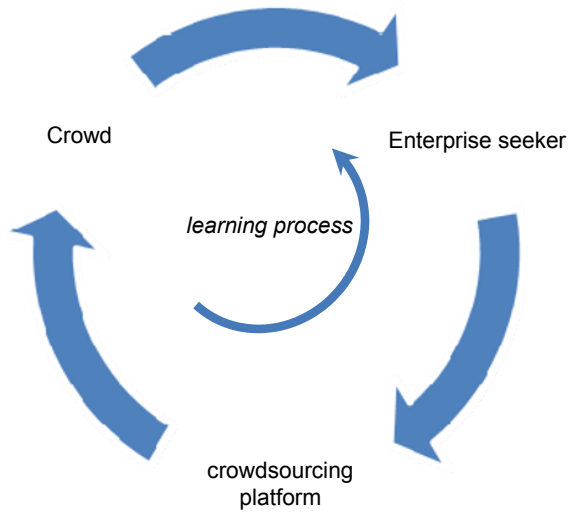

Figure 21.4. *Crowdsourcing of complex tasks and learning*

Thus, we can distinguish the different types of crowdsourcing according to the nature of the knowledge sought and its impact in terms of knowledge expansion (Table 21.1).

CS Type	Data crowdsourcing	Crowdsourcing of ideas	Crowdsourcing of knowledge
Cognitive level	Routine	Creativity	Expertise
Expansion of knowledge	Indirect. Data integration will allow the creation of information and then codified knowledge	Indirect. The integration of new ideas allows the expansion of the company's creativity	Direct through the integration of new knowledge produced by the crowd. Indirect through learning

Table 21.1. *Crowdsourcing and knowledge expansion*

21.7. Conclusion

In its current acceptance, crowdsourcing refers to the mobilization of a significant number of potential contributors. The notion of a crowd is then understood in the sense of the multitude of actors, or as a pool of resources. From the point of view of knowledge expansion, this vision of the crowd leaves little room for interaction between actors. As we have seen in the first section of this chapter, the crowd accepts a second definition: a large set of interacting actors, acting toward a common goal, and endowed with their own intelligence. This type of crowd is naturally not very present in the crowdsourcing phenomenon. On the contrary, in the three types of crowdsourcing, we have proposed that the independence of the actors allowed by the Internet is one of the *sine qua non* conditions for the success of a crowdsourcing approach.

In the wake of crowdsourcing, other uses of crowds have emerged, involving different relationships with crowds. Crowdvoting uses the votes of the crowd for decision-making processes. For example, in the Lego Ideas system, concept selection is based on peer voting. The number of votes obtained is generally public, which may lead to cascading phenomena (see section 21.1). This phenomenon of interactions, which has not yet been studied in the specific case of crowdvoting, is well-known in the field of decision making under uncertainty. Crowdfunding is a version derived from crowdsourcing, which mobilizes crowds for financing projects (the term "participatory financing" is also used). As with crowdvoting, the success of projects (i.e., the rate at which the desired funding is achieved) is generally communicated and, again, cascade phenomena can be observed where a highly funded project is likely to attract more new funding.

Finally, interaction phenomena can occur in creative crowdsourcing or problem solving projects that generate community behaviors (Dupouët *et al.* 2016). Indeed,

more and more companies are seeking to use the crowd not only as a pool of resources, but also as a pool of knowledge production interactions. But in such practices, independence remains a condition for success, since each community remains independent of the others. The resource is no longer a multitude of individuals, but a multitude of communities. These practices, which are still relatively emerging, make it possible to establish a link between the use of crowds and the community of practice mechanisms developed in Chapter 19 (Bootz and Dupouët 2018) of this book.

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PART 4

The Variety of Extreme Situations and Disciplinary Perspectives

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
First Edition. Edited by Pascal Lièvre; Monique Aubry and Gilles Garel.
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SECTION 10

The Variety of Extreme Situations

22

The Routines of Creation: From Artistic Direction to Collective Exploration

22.1. Introduction

What funny species creators are! They spend their time distinguishing themselves, inventing a personalized universe conducive to imagination and creation, but now they have nothing better to do than to work together to create. The inevitable collaboration and the necessary confrontation with the other imply a form of organization of creation, which, at times, can lead the creator to shout aloud: "Hell is other people". Despite this, it is impossible to avoid it because without others, there can be no singularity and without collaboration, creation remains an impossible activity (Becker 1982).

Even if it means collaborating and facing the difficulties that this implies, it is better to organize the modalities to facilitate the coordination of these activities. This reflection is particularly relevant in the creative industries (publishing, fashion, cinema, architecture, design, etc.) whose main resource is the talent that needs to be managed. Management, defined as "the practice of organizing everyone's collaboration with everyone and the well-being of the community" (Déry 2007, p. 76), thus appears as the discipline that supports this reflection on the problems posed by collective creation.

Therefore, this observation allows us to look at creative enterprises and to explore the interactions between creative individuals and organizations. While at first glance "routine creation" seems to be an oxymoron, it, nevertheless, covers a concrete reality both on an individual and organizational level. A creator's day is organized around landmarks and rituals, so that they can produce and give the best

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Chapter written by David MASSÉ.

of themselves (Currey 2013) and by definition, processes and structures bring certain stability to organizations through a standardization of individual behaviors.

However, no empirical study focuses on the different links between these two levels of analysis in the creative industries (Massé 2015). The fascination that surrounds creative activity tends to focus attention on the creator's personality to the detriment of the organized dimension of their work. As a result, organizational routines in the creative industries remain poorly studied.

Thus, our research attempts to help fill this gap. Two main objectives have been put forward: (1) describing the influence of talent on the organization (and more specifically on organizational routines) and (2) defining the characteristics of routines and their transmission in the context of the creative industries.

The exploratory nature of this research and the questions put forward led us to conduct three company case studies. The purpose of these three cases is to study training as a means of transferring routines in the creative industries sector. Placing training as an object of study is justified because this type of scheme requires a certain formalization of transmission, which has the consequence of making routines more visible to the researcher. The training of artists at the Cirque du Soleil, game designers at Ubisoft and equestrian riders at the *Académie du spectacle équestre de Versailles* are the main topics of this chapter.

First, we show that the organization can have a unique vision of creation: a form of porosity is observed between the vision carried by the creator (artistic direction) and the organization of the company. In this way, we demonstrate the influence of the creator and their vision on the organization, in particular by setting up recruitment and training mechanisms to support the creation routines specific to these companies.

In a second step, the analysis of the three training cases allows us to learn more about the nature of routines in the context of these industries. Indeed, we analyze the transmitted routines and two types of routines are highlighted: macro-routines that are the visual links carried by the creator in the organization and the micro-routines that allow talents to express themselves through the accommodation of talents to the constraints of macro-routines.

22.2. Three training schemes in the creative industries

22.2.1. *Guy Laliberté and the transformation of athletes into artists at Cirque du Soleil*

In 1984, when Cirque du Soleil was created, Guy Laliberté developed a unique vision of creation, a break with the traditional circus, which would later become the

company's DNA. This vision is based on the absence of animals and the importance of comedy and acrobatics in the numbers. To support this vision, the model developed consists of recruiting technical skills and training for missing artistic skills. At Cirque du Soleil, the choice of recruitment is based on the rarest quality sought: acrobatics. To perform the many acrobatics of its acts, the company therefore draws on talent pools from the world of top-level sport and in particular from the world of gymnastics. In order to recruit from these unique talent pools in the arts world, the company has had to set up extremely efficient recruitment systems. Nevertheless, recruiting profiles from the world of sport first led to a feeling of declining artistic quality of performances and the multiplication of injuries among athletes who entered the shows. Following these two observations of failure, management decided to set up a training program in 2003 for new recruits from the world of high-performance sport.

22.2.2. *Serge Hascoët and game design training at Ubisoft*

Ubisoft was founded in 1986 and Serge Hascoët began working as a game designer in 1988. Little by little, he developed a vision of game design that would really take shape during his collaboration with Michel Ancel on the *Rayman* game in 1995. In this game, he developed a vision of game design centered around the player, which later came to be called rational game design. To support this vision, Ubisoft's model consists of recruiting talent who are passionate about the product (i.e., talent with significant knowledge from their use of the product) and training them in company-specific creative techniques. For example, game designers have historically been recruited on the basis of profiles of enthusiasts who have a very good knowledge of video games. In a way, these are lead users (Von Hippel 1986) who have developed creative practices mainly from their gaming practices (and sometimes also from their practice as game creators). This type of recruitment has led to significant differences in skills between game designers, but also between studios in creative practices, which have impacted the overall quality of games. In addition, according to editorial management, mistakes seemed to be repeated throughout the company's various games, as game designers did not provide the right answers in terms of challenges for players. Thus, in 2010, a training course called the *Académie du design* was set up to train game designers in design techniques.

22.2.3. *Bartabas and the Académie du spectacle équestre de Versailles*

The *Académie du spectacle équestre de Versailles* (ASEV) is a school created by Bartabas in 2003. Through his experience in his equestrian theater company, Zingaro, Bartabas has developed a vision of equestrian art that lies between theater

and horse riding, breaking with the traditions of the great dressage schools such as the *Le Cadre noir de Saumur*, the Portuguese equestrian art school or the Spanish school in Vienna. Thus, ASEV recruits talents with technical and artistic backgrounds that remain easily workable during training. At ASEV, not being able to recruit from the world of the arts (no knowledge of equestrian techniques) and from the world of equestrian sport (trained for sporting movements) encourages the recruitment of workable talents. These are individuals with potential for training and artistic expression. A few solid equestrian foundations are, nevertheless, necessary to detect this potential when recruiting talent to the academy, but they are not enough. The fact of recruiting a workable talent implies from the beginning of the training the implementation of an improvement in equestrian dressage, as well as a training in artistic disciplines to develop new sensitivities (Massé 2016).

	Profiles needed to support the creator's artistic vision	Recruitment schemes (the profiles to be recruited)	Training schemes (the skills that will be developed)
Cirque du Soleil	Artists/athletes (gymnasts)	Athletes (sporting types)	Artistic
Ubisoft	Artists/passionate engineers	Passionate	Rational game design techniques
ASEV	Artists/horsemen/women	Workable potential	Artistic + equestrian dressage technique

Table 22.1. *Influence of the creator and their vision on the organization*

22.3. The routines of creation: from artistic direction to the collective exploration of talents

Training in the creative industries involves transmitting routines specific to creative activities[1]. Thus, we observe in these training schemes the transmission of

1 However, the three cases do not illustrate the same type of routines. It is, therefore, important through a first level of analysis, to differentiate between two types of routines that are part of the reality of creative routines: design routines and interpretation routines, which involve significantly different activities. Design routines are the routines that affect creative production activities. For example, the painter and sculptor are creators who design new products in the field of the visual arts. In the case of video games, the game designer can be considered as a designer. Interpretation routines involve activities where a performer (or group) makes an artistic creation available to the public through the interpretation of a written score. The musician and the actor are performers. In our case, the ASEV riders and Cirque du Soleil artists are performers. While interpretation and design cover different activities and

routines that support artistic direction (macro-routines). But this training is far from a case of acting as simple links, they also transmit routines that support the expression and autonomy of talents in relation to the vision carried by the creator (micro-routines).

Thus, at the opposite of the image of the routine set up on an assembly line, the routines transmitted in these three formations seem to be far removed from the routines implemented in the industrial worlds.

22.3.1. *Macro-routines: the "direction" links given by the creator*

Macro-routines are those that allow the operationalization of the creator's vision. They help to shape the company's identity and DNA in terms of creation, i.e. the company's own "creative style". Their main fields of action concern (1) the determination of the creative material (i.e. the resources made available to talents) and (2) the prescription of creative tools and techniques.

22.3.1.1. *Determining material available for creation*

The macro-routines that result from the creator's vision determine the creative material available for creation itself. In general, creative material can be defined as all the resources available for the creative activity. The material can be human, animal, digital or in the form of objects (non-human). A creator can thus voluntarily decide to do without a category (or subcategory) of material such as Guy Laliberté, who decides not to use animals or to mobilize resources that are not traditionally used in universe, such as artists from the sports world. It is a way of combining different types of creative material: human and technical equipment in the case of Cirque du Soleil.

The notion of creative material depends closely on the level of analysis we place upon ourselves in order to study cases. For example, the creative material for Bartabas includes all the ASEV resources at its disposal, which are teachers, riders and horses. We can also place ourselves at the level of the riders, in this case, the creative material rests on themselves (their body, their techniques, their sensitivity, etc.) as well as on the horses. The interest of the comparison of these three cases is also based on the differences and complementarity of the types of creative material: human and technical equipment at Cirque du Soleil, digital at Ubisoft and human and animal at ASEV.

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professions, this nuance must be put into perspective, as both interpretation and design include a significant part of creation. For example, even if the score is given at the beginning, the movie's actor has considerable leeway in his interpretation of the text. This freedom of creation is in a way similar to an activity of designing a new interpretation.

In the case of interpretation activities, macro-routines are supported by the prescription of artistic and sports techniques during training. At Cirque du Soleil, the training of artists involves a strong form of prescription insofar as it requires the acquisition of a certain number of artistic techniques that are at the root of the transformation from athlete's life to artist's life. At the end of this training, if the talent does not master the range of techniques taught, it will not be able to join Cirque du Soleil. The acquisition of artistic techniques is therefore a criterion for selecting artists. The challenge for new recruits will therefore be to integrate these new interpretation tools and techniques, some of which are very different from the habits developed during their lives as top athletes (see Table 22.1 of the comparison between the arts and sport world in the Cirque du Soleil article). In addition to artistic techniques, ASEV also offers sports training techniques. The techniques specific to each discipline are transmitted to the horsemen/women by a teacher in the field studied. For example, in the discipline of equestrian dressage, it is Carlos Pinto (coach and international dressage rider) who will transmit the technique from the equestrian sport world. Each teacher's mission is to transmit the techniques that will allow the horsemen/women to express themselves in ASEV shows.

In the case of design activities, macro-routines are supported by a company's own philosophy, vocabulary, tools and creative logic. The training of game designers at Ubisoft requires the integration of rules and knowledge about game design. They are prescribed through training, carried out by the headquarters, but which is deployed on all project teams in the various studios around the world. The objective of this training is to coordinate the teams among themselves and to establish game design conventions. Unlike Cirque du Soleil, the use of these design techniques is not a talent selection criterion because the trained talents are already working at Ubisoft. On the other hand, the use of these design tools and techniques may or may not be promoted by project management. A game producer can easily block the use of these techniques if they see in their implementation a risk of slowing down the project.

In both configurations (interpretation and design), the prescription of tools and creative techniques implies an assimilation phase in the sense of Piaget (1977). The game designer will have to assimilate and integrate a philosophy and logic of creation as well as a vocabulary and tools of creation specific to the company. The ASEV horseman/woman and the Cirque du Soleil artist will have to assimilate new artistic techniques. Vocabulary, tools and techniques are means of expression specific to the company's context, without which the expression of the creator and interpreter seems impossible.

Finally, through the determination of the material available for the creation and prescription of tools and techniques, macro-routines shape the company's own identity in terms of creation. The purpose of these routines is to "learn to be" within

the company, i.e. to create in the case of game designers or to perform at Cirque du Soleil or ASEV. The prescription of these techniques and tools can be more or less strong, ranging from a simple prescription for use at Ubisoft to a recruitment criterion at Cirque du Soleil[2]. These prescriptions also require the acquisition of company-specific means of expression based on the acquisition of new artistic techniques until the assimilation of a philosophy and a logic of creation, a vocabulary and tools. They are mainly transmitted through a top-down logic.

22.3.2. *Micro-routines: exploration spaces for talent*

Creative routines are not limited to the simple mechanistic vision of creation suggested by macro-routines. Another type of routine is also at work in the training processes that we call micro-routines. These routines are opposed to the former because they give a form of autonomy from the creator's vision and provide new spaces of expression for the company's talents.

Indeed, micro-routines support a form of flexibility that is conducive to change – in the organization, allowing talent to adapt to new creative challenges. This type of routine is intended to accommodate the framework given by macro-routines. They are an important source of renewal for the organization and are expressed mainly through a performative aspect. These routines occur as a result of a company's failure, learning in action, or the replication of good practices used in other companies. They can also have an ostentatious aspect insofar as they transform existing macro-routine frameworks and thus become rules and standards. Some individuals or communities of practice seem to be at the root of learning in action and the implementation of new routines whose emergence responds to a bottom-up logic.

"It is the relationship that the artist maintains with his material that gives birth to it, it is this way in which he will be able to play with the constraints that the material dictates that will make him an artist" (Bartabas 2012, p. 10). As Bartabas' quotation underlines, the routines communicated imply the transmission of a capacity for exploration and play with the opportunities and constraints of the material. We have thus proposed the concept of creative negotiation (Lê *et al*., 2013) to illustrate this relationship between the creator and their material, which we will discuss in this chapter through three types of logic: (1) an exploration logic, (2) a bypass logic and (3) a hybridization logic.

2 At Cirque du Soleil, the fact that they are unable to master the interpretation routines following the training prevents artists from being able to join the company.

22.3.2.1. *A logic of exploring the material possibilities: the case of acrobatic equipment*

While Cirque du Soleil artists have a technical mastery of certain sports equipment (rings, parallel bars, beams, trampolines, etc.), they must adapt to new equipment and develop a command of it that involves an artistic dimension. For example, in the show *Cortéo*, the trampoline becomes a "trampoline bed" with bed rails and pillows. Acrobatic figures are transformed to exploit the creative potential of this new equipment. The artists thus play with the constraints of the equipment by using the headboards to bounce from one bed to another. In addition, the symbolism of the bed is exploited through new figures – bouncing on your back, throwing pillows, etc. – which are not technically difficult to achieve, but which contribute to conveying emotions to the viewer.

22.3.2.2. *A logic of circumventing the limits of the material: the Rayman case*

Game design training also requires the acquisition of an ingenious form of play with digital material. Let us take the example of Rayman, the famous character from Ubisoft, born in 1994 from Michel Ancel's sketches. At the time, it was technically impossible to display this character with animated legs and arms. The creative answer was to create a hero without legs and arms. This design change, imposed by technical limitations, radically changed the gameplay (playability) of the game. The armless character can thus throw his hands to kill his opponents. This example illustrates that the constraints of the creative material have not led to a blockage in the creation process, but have led to bypass solutions that give rise to new creative ideas. This case, therefore, shows that the material can inspire by its limits.

22.3.2.3. *A logic of hybridization of different universes: the case of the "infusion" of artistic disciplines in the relationship between the artist and their material*

The creation of the ASEV is based on the hybridization of the discipline of dressage and artistic disciplines. In a compartmentalized way (the courses are given by teachers specialized in the discipline), the techniques of the various artistic disciplines (dance, singing, kyodo, archery, etc.) are taught in order to develop the rider's sensitivity. In parallel, the techniques of the dressage discipline are learned through a dual learning process between (1) the teacher who teaches the technique to the rider and teaches them to teach the horse and (2) the horseman/woman who learns from the technique of the old horse, while teaching the young horse (each horseman/woman has four to six more or less experienced horses). The old adage of riding takes on its full meaning here.

But the originality of this training developed by Bartabas is based on the impact of learning artistic disciplines (techniques and sensitivity), and also based on the

relationship between the rider and the horse by rebound (or infusion). In a way, routines are transmitted from the world of sport (dressage) and from various artistic worlds and it is the hybridization of these routines that gives rise to new forms of interpretation routines (see Table 22.2).

	Macro-routines	Micro-routines
Origins	Vision carried by the creator (type A talent) Technostructure	Learning by action of talents (type B) Communities of practice
Actions	Determine the material available at the time of creation Prescribe creative tools and techniques	Explore the possibilities of the material Bypass material boundaries Hybridize different universes
Effects	Operationalize the vision carried by the creator Shape the company's own identity and creative style Coordinate the organization of creation	Support the actors' learning involved in the creation Renew, adapt and evolve creative routines
Nature	Mainly ostensive	Mainly performative
Transmission	Top-down logic Assimilation of macro-routines	Upward logic Accommodation of macro-routines

Table 22.2. *The characteristics of macro-routines and micro-routines*

22.4. Conclusion

After describing the two types and characteristics of creative routines, we will conclude with the "tricks" used to transmit the two types of routines. The transmission is a real challenge for the company because it is the cornerstone for exploration in the company.

The transmission of creative routines here implies a phase of assimilation and a phase of accommodation in the sense of Piaget (1977)[3], which contributes to the

3 However, the mobilization of Piaget's work requires some theoretical precautions. As such, we bring the concept of schema closer to that of routine, which can be defined as a "framework of identifiable actions", i.e. a "structured set of the generalizable characters of an action" (Piaget 1977). More precisely, Piaget and Inhelder (1966, p. 11) defined a schema as "the structure or organization of actions as they are transferred or generalized when this action is repeated in

performative aspect of creative routines. But just as there is no assimilation without accommodation (Piaget 1977), there is no ostentatious aspect without a performative aspect (Feldman and Pentland 2003) and there are no macro-routines without micro-routines.

In the context of these three training courses, transmission thus implies the implementation of "tricks" to support the simultaneous transmission of both types of routines. The notion of a "trick" is used in Becker's (2002) sense, namely "a specific operation that makes you discover how to overcome a common difficulty, that proposes a procedure to solve in a relatively simple way a problem that otherwise might seem inextricable and persistent" (Becker 2002, p. 25).

22.4.1. *Trick 1: highlighting practice in transmission*

In general, the training courses studied place important on practice. Practical workshops represent more than 70% of Ubisoft's training time and all of the time at ASEV and Cirque du Soleil. Training therefore requires experience, practice and "doing", which, on the one hand, will reinforce the ostensive aspect of the routines transmitted (Feldman and Pentland 2003), and, on the other hand, promote the individual's appropriation of these routines. We show in particular that practice allows artists at Cirque du Soleil to appropriate the tools, and that through practice we push to go beyond the primary use of the tools and thus to get out of the box. This appropriation is close to the accommodation phase, i.e. we are witnessing the development of new routines based on the reorganization of what the individual already knows following the assimilation of new knowledge. Tricks even seem to have been designed to promote accommodation through a reduction in feedback to Cirque du Soleil (trick 2, see section 22.4.2) and an uncertain learning horizon at ASEV (trick 3, see section 22.4.3).

22.4.2. *Trick 2: fostering accommodation through the reduction of feedback*

The remark "Tell me what to do!", given by a Cirque du Soleil athlete to his trainer underlines his desire to have precise instructions on a role to be performed.

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similar or analogous circumstances" The main difference between the schema and the routine therefore seems to be the field of application and the community of use: the schema is used in psychology for the analysis of the individual, whereas the concept of routine was originally developed by economists (and taken up by managers) and applies to the firm. However, both concepts cover common realities.

The system set up to answer this question consists (at a given time during the training) of not answering the question precisely, but in gradually reducing the feedback in order to make the artist responsible and autonomous.

REMARK.– "Tell me what to do!" Many gymnastic athletes come from countries of the former USSR, known for the excellence of their talents and the elitism of their sports training. The new artists are technically very good; they have been used to training rigorously and receiving accurate feedback from their coaches. During the artistic training of the act, Circus coaches are sometimes confronted with symptomatic reactions: "If something is wrong, tell me what to do!" The answer developed by the coaches is not to answer this question with a precise answer. They explain to the athlete that they will be placed in an environment conducive to creation, but that the process of creation and learning belongs to them. The philosophy of this method is to gradually reduce comments to empower the artist and make them autonomous.

This places the artist in an environment conducive to their personal expression by encouraging the artist's accommodation in relation to the artistic techniques previously learned.

22.4.3. *Trick 3: creating an environment conducive to uncertainty*

The feedback reduction system emphasizes the need to create an enabling environment to facilitate the accommodation of transferred routines. Uncertainty in the sense of a learning factor, self-expression factor and discovery factor (Menger 2009), thus, plays an important role in the creation of this environment. Indeed, the characteristics of creative and performing activities consist of remaining extremely variable in their courses. The circus artist, horseman/woman and game designer have activities that involve extremely variable and flexible routines in their applications. The challenge for the company is, therefore, to be able to welcome and encourage the emergence of new routines through an environment conducive to creation and interpretation.

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23

The Young Researcher Program for Extreme Situations

23.1. Introduction

This chapter puts into perspective doctoral research developed as part of the "*Management des situations extrêmes*"[1] (MSE) research program under the direction of Pascal Lièvre, professor at the University of Clermont Auvergne. This work highlights a variety of objects, terrains and theoretical frameworks. In this introduction, we illustrate this variety based on the different thesis subjects that have recently been defended or are being prepared, emphasizing their contributions: Feedback and Organizational Learning: the Case of Fire Rescue Services (defended by Anaïs Gautier in 2010); The Complexity of Appropriating Enterprise Resource Planning (ERP) in a Petrochemical Industry (defended by Nabil Ait-Taleb in 2014); Logistics Based on Knowledge Flows: Learning and Performance in Space Exploration Simulation Situations (defended by Emmanuel Bonnet in 2014); Innovation in Management Tools in Cultural Organizations of Performing Arts – Bissociation and Creativity in Extreme Management Situations (defended by Jacques Chabrillat in 2018); The Management of Epistemic Communities: a Comparative Case Study (currently being prepared by Nicolas Laroche); The Role of Organizational Routines in the Coordination Factory Among Firefighters in Charge of Personal Rescue (currently being prepared by Amélie Andrey); The Construction of Action Knowledge in Action Portfolio Managers: a Video-ethnographic Investigation of an Expert (being prepared by Stéphane Cellier-Courtil); Creation and Conversion of Knowledge within a Cooperation Project between France and China in the Medical Sector (being prepared by Jing Tang);

Chapter written by Christelle BARON, Emmanuel BONNET, Stéphane CELLIER-COURTIL, Nicolas LAROCHE and Isabelle MAGNE.

1 Management of extreme situations.

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What is a Power that Promotes the Emergence of the Potential for Action of Actors in Situations of Uncertainty? (being prepared by Christelle Baron); the Ideation Activity of Innovative Entrepreneurs from an Interactionist Perspective: a Comparative Case Study of Micro Business (being prepared by Géraldine Marquet); and The Modalities of Engagement and the Processes of Regulation of Collective Action in the Context of the Liberated Company: the Case of Crédit Agricole Centre Loire (being prepared by Isabelle Magne). While this diversity contributes to the progress of the research program, we show that it also renews our understanding of the situations facing companies today. Extreme situations that were initially perceived as unfamiliar and atypical are now becoming more widespread in a context increasingly marked by innovation and creativity. In this chapter, we present five doctoral projects that were presented at the Cerisy symposium in June 2016. Each project will be presented based on its purpose, theoretical framework, field and results. The projects were written by their respected authors: Christelle Baron (section 23.2), Isabelle Magne (section 23.3), Nicolas Laroche (section 23.4), Stéphane Cellier-Courtil (section 23.5) and Emmanuel Bonnet (section 23.6). In conclusion, we reveal some invariants of the "management of extreme situations" program from these five works.

23.2. What is a power that promotes the emergence of potential action among actors in situations of uncertainty?

The purpose of the research was to identify new forms of management that do not rely on command and control (Lorino 2005) and instead aim to unleash the power of employees to act. This is the question of the nature of innovative action and that of power that arises in the context of a knowledge-based economy (Foray 2009; Lièvre 2016), i.e. a "permanent innovation regime" (Levillain *et al*. 2014) where uncertainty prevails.

We used the theoretical framework proposed by the political philosopher Hannah Arendt (1961, 1954) to address these two questions. We were interested in the work subsequent to her analysis of totalitarianism that highlights the elements necessary for the reconstruction of a political space, which she believes is the only way to allow effective freedom of action for humans. Arendt's reading grid is based on the interlocking of three distinct activities (including action) of *vita activa*: (1) work serving to meet vital needs, which is a cyclical activity; (2) work that is part of duty and creates a world of durable objects; and (3) action that is punctual, breaks with usual processes, and is always collective. In this context, the action is not only extreme (Lièvre 2016) but also intrinsically innovative, since it involves "three constant problems" (Arendt 1961, p. 283): (1) the process it initiates is irreversible, (2) the results are unpredictable because (3) the action results from a plurality of

agents. Original collective action then implies a "fertile ground" (Cohendet *et al.* 2010) in which to preserve the novelty of action, i.e. "the establishment of a common world in the organization [...], of a collective action that produces new communities" (Levillain *et al.* 2014). The discovery of these characteristics of action as collective, innovative and as the creative element of communities is also an opportunity to distinguish the "power-to" that is then exercised in common action as a "power-in-common" (Quelquejeu 2001), i.e. no longer as a "power-over", which is in fact a definition of violence. Thus, the concept of "power-to" can be decomposed as: "(1) the ability to act (2) in concert, (3) which belongs to a group and continues to belong to it as long as this group is not divided" (Arendt 1961). This increases when it is shared (Follett 1949, 2015).

We invested in two Parisian coworking spaces, one physical and the other virtual, on an ethnographic level and with a grounded theory methodology (Glaser and Strauss 1967) to document this form of leadership that liberates the power to act and that is part of the power in common. These coworking spaces as new emerging organizational forms are the subject of much work and are part of the new "hybrid spaces" (Boboc *et al.* 2014; Fabbri 2015, 2016a,b), or *Localized Spaces of Collaborative Innovation* (Capdevila 2017) supposed to break the isolation of entrepreneurs but also to promote the creation of "innovation communities" (Cohendet *et al.* 2010).

Our initial investigations showed that the activities of these two very particular coworking spaces not only fell within the three forms of activities distinguished by Arendt, but that the animators–managers–initiators of these spaces have consciously invested these activities as essential to make their communities "live". Power, although updated in a different way, is in both cases a practice of action in common, which must always be reaffirmed in action.

23.3. The terms of engagement and the processes for regulating collective action in the context of the liberated company: the case of Crédit Agricole Centre Loire

The purpose of this student's thesis was to identify the nature of employee engagement in their work and the collective regulation methods necessary to develop employee empowerment and responsibility. Adopting the posture of *Anchored Theory* (Glaser and Strauss 1967), we mobilized various theoretical frameworks: the work of Decy and Ryan (2000) on motivation, the work of Reynaud (1988) on the question of the coupling between autonomous regulation and control regulation, and work directly related to the liberated enterprise by researchers (Getz 2009, 2010, 2012, 2016; Chabanet *et al.* 2017; Colle *et al.* 2017; Gilbert *et al.* 2017)

but also reflexive practitioners (Zobrist 2008a,b; Nayar 2011; Croset 2014, 2017; Munzenhuter 2016) as well as older pioneering works of this movement (Dubreuil 1929; MacGregor 1960). We also researched companies that have just implemented this type of "liberation" approach: Michelin and OCP. We hypothesize that employee empowerment and responsibility is a necessity from the perspective of the new form of 21th Century economy (Lièvre 2016).

The research involved a major French bank that wanted to engage in a process of free speech, Crédit Agricole Centre Loire, a mutualist bank present in the Cher, Loiret and Nièvre regions (2,000 employees). The company is currently managed in a very traditional way: managers are in charge of strategy and operators are simple executors. The managing director wished to bring about a profound change in the company by freeing up the floor so that it could find new levers for growth and remain competitive. Behind this freedom of speech was a broader business project to turn it into a collaborative enterprise. The Director-General wished to be supported because the tools put in place to carry out this release had proved unsuccessful. Middle management felt deprived of its intellectual aura and power. The latter aspect had been largely underestimated. We proposed to build a support system for the liberation of the company by proposing reflexivity loops to management.

We have highlighted the link that companies spontaneously make between the knowledge economy, which generates an imperative for innovation, and liberated companies (Lièvre and Magne 2018). We have established a clear history of the construction of the new business project and observed an agency that is trying to implement the Executive Director's vision. Our initial results show that the executive board wants a company organized horizontally, while the principles of verticality persist and a culture based on respect for procedure and hierarchy prevents employees from taking the initiative and having their say. Our in-depth ethnographic investigations reveal many bottlenecks in the organization that we translated as controversies in the sense of Latour (2006) but which were unidentified and unresolved.

23.4. The rules of the game of an epistemic community

The central theme of this particular thesis was to consider that the evolution of our economic framework toward a knowledge economy favors the emergence of new actors or new forms of cooperation between research and society aimed at creating knowledge, i.e. knowledge communities (David and Foray 2002) and more precisely epistemic communities that deliberately involve researchers and practitioners. *What are the rules of the managerial game in epistemic communities?* This was the purpose of the research.

There are two main forms of communities of knowledge: communities of practice (Wenger 1998) and epistemic communities (Haas 1992). The latter concept was developed by two groups of researchers: on the one hand, in political science, and on the other hand, in economics and management sciences. We followed the lead developed by Cohendet *et al.* (2006), which deliberately articulated these two research programs. Thus, the epistemic community is a collective of heterogeneous actors who come together in a structured way through a procedural authority to construct knowledge that will take the form of a codebook for external use.

To clarify this notion of procedural authority and more broadly to address the question of managing an epistemic community, we conducted a concomitant study, in an ethnographic way, of two epistemic communities since their origin: the *Pour et sur le dévelopement régional* (for and On Regional Development) program (PSDR 4): Inventing our Territories of Tomorrow, led by Sylvie Lardon (DR, INRA) and Dominique Vergnaud (Director of the Parc Livradois Forez); and the CRCGM's Open Lab Exploration Innovation, led by Pascal Lièvre (PR, UCA) and Frédéric Denisot (Innovation Project Manager at the CCI du Puy de Dôme).

We followed both systems in a participatory-observational posture with meetings, seminars and debates being systematically filmed, recorded and decoded. Our first results show both commonalities and differences. Thus, the notion of controversy in the sense of Latour (2006) appears to be an important element in reflecting the dynamics of collective action, knowing that they are the subject of the first system of *ex post* clarification from a public point of view, and that in the second system, they are made explicit only in private discussions. But in both cases, the pilots mobilized controversy to lead collective action.

23.5. Constructing action knowledge for a wealth management advisor

The starting point of this work was a questioning of the nature of the knowledge actually mobilized by financial market participants. This was based on certain dissatisfactions, in terms of efficiency, with a practice as a private manager and the difficulty of basing it exclusively on the principles of orthodox finance. In an unpredictable, uncertain and highly evolving economic and financial environment, could probabilistic methodologies derived from normal law be used to understand the evolution of financial markets and control the related risk? Conventional finance remains the taught framework for the functioning of markets. However, as early as 1936, Keynes wrote:

> "In addition to the cause created by speculation, economic instability finds another cause, inherent in human nature, in the fact that a large number of our activities [...] are based more on spontaneous optimism

> than on mathematical prediction... The exact calculation of profits plays a role only slightly greater than in an expedition to the South Pole".

If the orthodox economy is insufficient to explain the variations in financial markets, how do financial experts act in situations if they do not act according to a classical model of decision-making? What knowledge do they mobilize?

The register of this thesis was that of intermediate theories at the interface of practices and the universalist theoretical corpus from a Grounded Theory perspective (Glaser and Strauss 1967; David 2000). We followed the path of the finance factory (Chambost *et al.* 2016) away from classical orthodox thinking. We proposed an investigation of "practices" in the sense of Pierre Bourdieu (1980, 1994), an expert on financial markets, by using a video-ethnography technique. We considered the financial market player as a manager (Thevenet 2009) in charge of a management situation in the sense of Jacques Girin (1983) and we even considered this to be an extreme management situation where scalability, radical uncertainty and risk prevail (Lièvre 2016). These were very traditional characteristics due to the financial market environment. But they led us, from the point of view of a heuristics of extreme situations, to focus on the process of expanding both experiential and scientific knowledge in the course of collective action (Lièvre 2016).

We worked with an expert in financial markets in the form of a Parisian equity portfolio management company using a video-ethnography system. For a week, we continuously identified the knowledge actually mobilized by the members of this company through the prism of controversies (Latour 2006) that emerged in a situation between actors.

Finally, we defended the theory that the knowledge mobilized by financial market participants is based on a combination of academic knowledge that articulates the paradigm of orthodox, behaviorist and mimetic finance on the one hand and experiential knowledge on the other. This is knowledge acquired in practice outside any theoretical framework.

23.6. Rethinking logistics from knowledge flows

The explanation of this research subject requires a quick return to the field of logistics. Logistics can be defined, from a management science perspective, generically as "a technology for rationalizing the flows of an organization in order to manage it" (Lièvre 2007). Historically, logistics in its attempt to model an organization in terms of flow has gone through different stages, each time pointing

to a specific type of flow. In a first step, it was the physical flows, then in a second step, it was the information flows, and today it is knowledge flows. Thus, it appears that the emergence of "knowledge flows" in organizations is becoming a challenge for the logistics management of our organizations (Fabbe-Costes and Lancini 2009). However, the articulation of logistics and "knowledge flows" is not self-evident. Indeed, a dominant approach to knowledge flows in logistics is rather based on an abstract and decontextualized vision of knowledge and organization that does not allow for a paradigm shift away from the information processing system model (Newell and Simon 1972). We proposed a knowledge-based approach understood as a practice (Gherardi 2006), an approach to knowledge as an activity that people conduct together where in fact the question of organizing activities are at the forefront (Weick 1995). The purpose of our research was to test the theoretical framework of knowledge-centered logistics as a situated practice. It was then necessary to invest in local practices to identify organizational principles.

This is what we undertook during a particular field of research – a simulation of a Martian exploration in the Utah desert – in which we participated for a fortnight by carrying out an ethnographic inquiry. As a crew member, we participated in the inquiry (Dewey 1938), that is, in the practice of producing collective knowledge that allowed collective action to take place. We reported on this practice using ethnographic materials collected and constructed during the simulation. We derived organizational principles that focused both on living and working together and on a distribution of the leadership function within the collective. Thus, a logistics focused on knowledge flows is possible if ordinary practices are invested in and considered as sources of experiential knowledge that can constitute reflexivity loops in organizations.

23.7. Conclusion

In this chapter, we have focused both on the diversity of research objects and the convergence of doctoral projects within the MSE program. This diversity depended on the attention paid to empirical research work, taking into account the singularity of the extreme management situations (Lièvre, 2005) that these researchers were trying to elucidate. However, there is convergence around the core of the research program. To conclude this chapter, we propose to identify some of the invariants of this work: (1) the critical importance of scientific and experiential knowledge articulation and its management in an economic context marked by intensive innovation, involving actors in extreme situations; (2) the modalities for investigating this knowledge based on organizational ethnography, which gives priority to the daily practices of actors involved in these situations; (3) the emergence of forms of collective action, new working practices and relevant

management methods in this economic context. We have thus shown that the expression of the plurality of these objects and their convergence around these invariants makes it possible to contribute to the progress of the MSE program.

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SECTION 11

Disciplinary Perspectives

Management of Extreme Situations: From Polar Expeditions to Exploration-oriented Organizations,
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24

Knowledge Transfer and Learning in Extreme Situations: The Psychologist's Vision

24.1. Introduction

As Lièvre (2016, p. 80) points out, in an economy "that has taken the form of a knowledge-based innovation economy since the 1990s", [...] "managing an organization appears increasingly to be part of a logic of implementing an innovative, knowledge-intensive project in an evolving, uncertain and risky context". It can, therefore, be considered that analyzing the processes of knowledge transfer and learning at the heart of these situations – often referred to as "extremes" – is crucial, particularly in the implementation of a form of *organizational ambidextrous environment in* which *exploration plays an* important role. However, in management sciences, the concepts of transfer and learning remain frequently used in the common sense and, at best, addressed with reference to information processing theories. However, as we will attempt to demonstrate by adopting a perspective rooted in developmental psychology, an approach based on activity theories can provide an alternative interpretation of the processes at play when dealing with "an evolving, uncertain and risky context".

We will discuss the use of the notions of *knowledge* in order, first of all, to highlight the interest of not treating them as synonyms and to underline, moreover, the consubstantial link between knowledge and action. Then, secondly, from the point of view of developmental and learning psychology, we will discuss the processes of knowledge and knowledge generation with regard to the notion of transfer. Finally, we will try to draw the main consequences from such a point of

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Chapter written by Jean-Claude COULET.

view for knowledge management, while emphasizing the non-exclusive place they occupy in the articulation between individual and collective skills.

24.2. Knowledge transfer: a questionable notion

Behind an expression, which is widely used and seldom questioned the notion of knowledge transfer is, in our opinion, a highly debatable topic – both with regard to the definitions given to the notions of knowledge, and with regard to what is implied about the transfer itself and its processes.

24.2.1. *The notions of knowledge*

What is knowledge? Obviously, while there is a lot of discussion in the literature, the answers to this question is far from unanimous and it must be recognized that behind the expression *knowledge transfer*, there are very many uses and interpretations.

However, the educational sciences clearly mark the difference between what is taught, on the one hand (academic knowledge, recognized in programs), and what is constructed by each student (their own knowledge). For their part, David and Foray (2002) do not fail to point out (even if only in footnotes):

> "There is reliable knowledge; that is, knowledge that is certified, reliable, robust and legitimized by one type or another of institutional mechanism (both scientific peer reviews and collective theories and beliefs). There are other forms of knowledge that, like the previous ones, allow action (I know how tend to my garden, I know how to do things), but have not passed the tests to which certified knowledge is subjected. This opposition does not refer to the opposition between scientist and non-scientist, but rather to the institutional tests that such knowledge passes or not: there is 'gardening knowledge', a reliable, general and relatively decontextualized knowledge; but each gardener also has their own local and situated knowledge. However, the knowledge-based economy does not exclude either of these two forms and is therefore not only an economy of formal production of certified knowledge." (David and Foray 2002, p. 26)

From our point of view, this quote is particularly enlightening on several levels.

First of all, it raises the problems related to the conceptualizations underlying the language forms used to express them. It is obviously not indifferent to have a single

term in the language used (for example, here: knowledge for English speakers) or several terms (for instance, in French: "*connaissance* and *savoir*"). Moreover, it indirectly suggests, in the same movement, the difficulties raised by the supremacy of a given language in scientific production.

More fundamentally, David and Foray's (2002) remarks lead to considering knowledge as social productions that give it its "reliable", "robust", "certified", "legitimized" character, through "institutional mechanisms", while knowledge remains "local" and "situated", specific to individuals: "Each gardener has their own knowledge." Indeed, individual knowledge may be scientific in nature while knowledge may not be scientific, as is the case, for example, when professional communities use conceptualizations that are only valid within them, often with very specific jargon (see, for example, in plastics processing, the "pragmatic concept" of *stuffing* mentioned by Pastré (1997)).

Finally, without emphasizing this aspect much, David and Foray (2002) emphasize a very essential point: knowledge is linked to action. However, this point deserves some additional comments, which we will come back to quite extensively in the following.

As for the question of knowledge transfer, as generally mentioned in the literature, here is what Hatchuel *et al*. (2002) say about expert systems, in an approach that is completely consistent with the previous one:

> "The metaphor of the 'collection' or 'transfer' of knowledge is often misleading: 'Expert systems do not imitate reasoning or collect knowledge, they can only work if they transform it' (Hatchuel and Weil 1995). More generally, we never really 'collect' the knowledge of others, rather we transform ours through interactions with them. Knowledge exchange cannot, therefore, be treated as the circulation of a currency. It is more accurate to think that, during the exchange, not only 'what everyone knows' changes, but also that each of us has a different idea of what we have given and received". (Hatchuel *et al.* 2002, p. 34)

24.2.2. *The development of knowledge*

24.2.2.1. *Knowledge development*

With regard to knowledge, as conceptualizations of the individual's physical and social environment and of who they are – particularly in their interactions with that environment – three crucial points must be highlighted.

First of all, as Piaget (1975) has shown very well, any new structure is only possible on the basis of a structure already present in a constant biological and psychological evolution. In this logic, any individual assimilation requires an assimilative structure whose current state is the result of a triple memory, both *phylogenetic* (offering a certain psychobiological equipment organizing interactions and adaptations to the environment), *sociogenetic* (offering, through a certain culture, certain forms and tools of interactions and adaptation to this environment) and *ontogenetic* (offering a certain specific experience of interactions and adaptations to this environment). Thus, any new knowledge can only be constructed on the basis of a certain "sensitivity" (Récopé 2019, see Chapter 14 of this book) to the environment, based on these memories and guiding the organization of the activity, which will notably allow, here and now, the capitalization of the experience it represents. In other words, there can only be a cognitive construction through the deployment of a *skill*, as "an organization of the activity for a class of situations" (Vergnault 1990), carrying these memories and processes responsible for the capitalization of the experience that the individual can draw from their mobilization.

A second point is, therefore, to emphasize that knowledge is consubstantially linked to skill. As individual constructions, knowledge is, in fact, processes mobilized for and in action because, on the one hand, it is a question of having sufficiently reliable conceptualizations to guide action and, on the other hand, of learning from it through the experience it represents. Thus (see also section 24.3), there is no possible action without conceptualizations to anticipate the results or to gather information that triggers and controls it throughout its implementation. Similarly, there is no possible knowledge without some form of conceptual capitalization of the experience of the process and results of the action. The processes at stake in the construction of knowledge are, therefore, those that organize the interaction of the individual with their environment, in an active approach, which has nothing to do with a simple storing that consists of storing knowledge as a transmitted object.

Finally, it should be noted that, while knowledge is constructed through processes distinct from those on which knowledge is built (see section 24.2.2.2), it is very closely linked to them. Indeed, a very large part of our knowledge comes from the appropriation of knowledge conveyed by cultures, both implicitly through social interactions and the use of material and symbolic tools, and intentionally, in particular, through their teaching.

24.2.2.2. *The development of knowledge*

Concerning the development of knowledge, as social productions with a "reliable", "robust", "certified", "legitimized" character (David and Foray 2002), through "institutional mechanisms", it is based on all the processes of creating an

explicit or implicit consensus between the knowledge brought by individuals from different types of collectives. Whether it is the procedures set up in research and publications to construct scientific knowledge or, more modestly, approaches leading to consensus in groups of different types to harmonize practices (see, for example, the development of the "pragmatic concept" of *stuffing* (Pastré 1997) mentioned above), whether this knowledge is formalized in authoritative documents (books or scientific articles, for example) or through simple verbal or pictorial signifiers, it is the consensus carried by these formalizations that constructs knowledge.

24.3. Learning: theoretical considerations

On a theoretical level, the diversity of learning theories suggests that it is difficult to account for the construction of knowledge. Indeed, for example, there is, at first glance, nothing in common between knowledge produced by *classical conditioning*[1] and knowledge produced by *sociocognitive confrontations*, as analyzed by authors such as Doise and Mugny (1981). However, on closer examination, it is difficult to deny the necessary activity of the subject for such constructions. In the first case, they result in an exploration of the regularities of the environment and, more specifically, of the co-occurrences of stimuli occurring there, until one succeeds in triggering the behavior initially caused by another. Secondly by clarifying and taking into account different points of view, through a confrontation or a sociocognitive conflict responsible for balance, in the Piagetian sense of the term. In other words, what is decisive in learning is the *skills* that the learner mobilizes when, in the first case, they explore the stimuli they face until they adapt their behavior to their characteristics and when, in the second case, they take into account the "disturbance" created by a different behavior from their own, to "regulate" their activity until they "compensate" for it (Piaget 1975). We cannot, therefore, account for the construction of knowledge without taking into consideration the subject's activity and, consequently, the skills associated with it.

24.3.1. *A modeling of skills*

In this logic, the skill model (see Figure 24.1) that we have proposed (Coulet 2011) to explain the processes involved in mobilizing and creating individual and collective skills makes it possible to further specify the close links that knowledge maintain with the activity. This model, inspired by the *activity theory* (essentially,

1 According to the famous example of Pavlov's dog, who was taught to salivate by the sound of a bell.

through the contributions of Piaget and Vygotsky) and by a number of more recent developments in these conceptions[2], provides a good understanding of the dialectical link between learning (in particular, the constructive side of activity, represented on the left side of Figure 24.1) with regard to the productive side of activity (right side of Figure 24.1)[3]. Thus, all activities are conducive to learning and all learning modifies the organization of the activity. In addition, this model highlights (see numbered orange arrows) the three types of adaptation involved in the productive and constructive aspects of the activity.

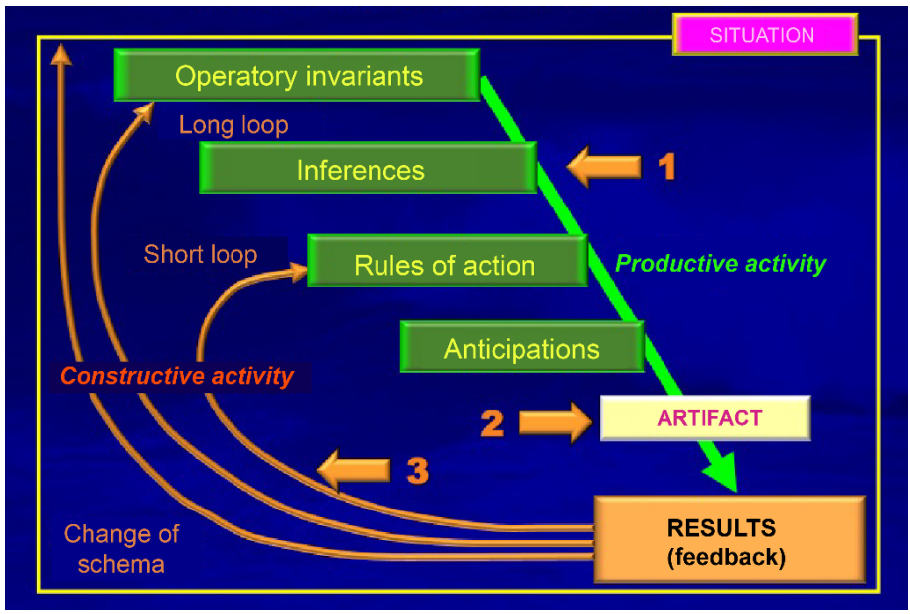

Figure 24.1. *MADDEC (model named after the French: modèle d'analyse dynamique pour décrire et évaluer les compétences (dynamic analysis model to describe and evaluate skills))*

First of all (arrow no. 1), it, based on past experience (i.e. previous learning), aims to adjust the organization of the activity according to the particular circumstances in which it takes place here and now. The *schema* ("productive

2 For example, the contributions of Vergnaud (1990), concerning the analysis of the notion of schema; Rabardel (1995), concerning the analysis of instrumented activity; and Pastré (1997), concerning the pragmatic and epistemic registers of activity.

3 The distinction between productive and constructive activity is proposed by Samurçay and Rabardel (2004).

activity" arrow in Figure 24.1), as described by Vergnaud (1990)[4], is indeed relevant for a range of situations and must necessarily be adjusted to the characteristics of the particular situation it encounters in its mobilization. It is then the inferences that have this adjustment function.

Then, arrow no. 2 concerns adaptation relating to the use of *artefacts* (see the concepts of *instrumentalization* and *instrumentation* in Rabardel (1995)), whose properties are both instrumentalized by the organization of the activity and sources of modifications of this organization of the activity, corresponding to another form of learning, induced this time by the artifacts, themselves strongly supported by the knowledge mobilized in their conception.

Finally, it is a question of adapting to the results obtained (arrow no. 3) carried by the three types of *activity regulation* and leading to relative learning:

– the organization of action sequences (action rules, the object of short loop regulations);

– the conceptualizations associated with the activity (the *operating invariants*, the object of long loop regulations), these conceptualizations corresponding, in Vergnaud (1990), to what the subject considers true (knowledge but also: beliefs, values, norms, etc.) and relevant to the activity undertaken (the elements of the situation to be taken into account in order to succeed);

– the relevance of the mobilized schema (as an organization of the activity associated with a range of situations) to other possible ways of dealing with this task, in this situation (regulation of the type of change of schema, corresponding to a reorganization of the schemas and the range of situations, respectively, associated with them).

24.3.2. *Forms of learning*

Through the description of all these processes, it is therefore clear that learning is not only inseparable from the activity but is far from being reduced to a simple construction of knowledge. Indeed, they can concern adaptations to the properties of

4 Vergnaud considers the schema as an invariant organization of activity involving four components: expectations of the result targeted by the activity undertaken; rules of action, subordinated to the activity undertaken and organized to produce this targeted result; inferences allowing the schema to be adjusted to the characteristics of each situation belonging to the class of situations with which it is associated; operational invariants that represent both what the subject considers true to justify the activity undertaken (Vergnaud: theorems-in-action) and what they consider relevant (in Vergnaud's work: concepts-in-action) to be taken into account in order to succeed in the activity undertaken.

artefacts used (instrumentation), modalities of production of the targeted results (short loop regulations) as well as other operational invariants such as beliefs, norms, values, focus of attention on one or another element of the situation (long loop regulations) or, again, on a reorganization of the activities themselves and the range of situations to which they are, respectively, associated (schema change loop). Moreover, if we accept (Bulea-Bronckart and Bronckart 2005; Coulet 2013) that all skills are deployed simultaneously on three levels: the relationship to the task (object of the activity), the relationship to others (all activity is addressed)[5] and the relationship to oneself (all activity involves the identity of the actor), it is clear that learning can concern dimensions where the imaginary and the emotional come to occupy a place that strongly reduces the strictly cognitive dimension even more.

As for learning that would be part of *knowledge transfer*, it is clear that it can only be conceived (Hatchuel *et al.* 2002) as individual re-elaborations of already constructed knowledge, in contact with the expression of the knowledge of others and through interactions in which everyone mobilizes skills that a particular form of regulation (long loop and specifically related to knowledge) can develop. At the individual level, access to new knowledge therefore necessarily requires the regulation of skills mobilized in an activity[6]. Consequently, speaking of knowledge transfer as a movement of knowledge is likely to mask the complexity of the processes involved and suggest that knowledge is a simple object that could ("like a currency"; Hatchuel *et al*. 2002) pass from one place to another. However, should we renounce the idea that cognitive evolutions can occur from those that other individuals or groups have themselves constructed? The answer is obviously no, but it remains to be understood what is at stake at the time.

24.4 Collective skills, learning and strategic management

While, as we have just seen, the link between knowledge and skills is absolutely essential to reflect individual learning, it takes on other forms when considering the evolution of knowledge in its relationship to collective skills.

24.4.1. *Knowledge in practice*

First, as already pointed out in the wake of David and Foray (2002), the development of knowledge presupposes an explicit or implicit validation of individual knowledge by a collective, in such a way that it becomes sufficiently consensual in order, in particular, to give a certain coherence to the collective

5 See Yves Clot (2001).

6 It includes listening to a lecture or reading a scientific book, for example.

activity that this knowledge accompanies. Thus, for example, the position on the field of the players of a football team, practicing a particular strategy in a particular circumstance, is known to each of the players. It is knowledge validated by the team, constituted by this team (possibly by others, possibly on the scale of the entire football community), that gives a certain coherence to the team's activity at a given moment in the match. Of course, this knowledge is not isolated and is combined with many others (the rules of the game, the conventional gestures produced by the referee, the name of this or that type of contact with the ball, etc.).

24.4.2. *The hierarchy of skills*

In addition, collective competence can be described using MADDEC (see Figure 24.1), considering that individual skills are nothing more than the rules of action mobilized by the skills of collectives whose skills are the collectives' rules of action that encompass them and so on. Thus, it is possible to report on collective skills corresponding to the organization of a company's (or even a territory's) activity in this logic of hierarchical interlocking of individual skills, up to collective skills. Taking the example of the football team, it is understandable that the skills of each player are solicited in the implementation of the skills of a larger collective (for example, that of defenders or attackers), whose skills are themselves solicited by that of the team.

24.4.3. *The articulation between individual and collective skills*

It is therefore important to stress that all these skills are far from being mutually exclusive. Everyone can observe the activity of others and thus benefit from all or some of their characteristics, particularly because these activities make sense to them because of their more or less direct involvement in similar or complementary activities. Thus, in such situations, elements of skills (or even skills as a whole) "percolate" between individuals on the basis of what, for example, the theory of social learning (Bandura 1980) describes in terms of vicious learning[7].

Of course, these subsymbolic vicarious learning processes do not exclude that informal or formal verbal exchanges increase their potential for borrowing and rejection, contributing to the construction, for example, of professional styles and genres (Clot and Faïta 2000), through processes of confrontation or sociocognitive conflict (Doise and Mugny 1981) and awareness (Piaget 1974a, b). On the basis of such *formalizations* (codifications) of competences, it becomes possible, this time,

7 For Bandura, vicarious learning is a process by which an individual models his or her behavior based on the observation of that of others.

to analyze in detail and explicitly the organization of the real activity and, in particular, its deviations from the prescribed activity.

The exploitation of this gap can then be the source of a redefinition of the organizational prescriptions of collective activity through a *regulation* mechanism (Piaget 1975), a mechanism that can be reported by the regulation loops of the MADDEC model.

Finally, starting from this redefinition of prescriptions, assuming new learning, both for individuals and groups in the service of the organization's activity, "learning assistance"[8] type support can be envisaged to increase its effectiveness based on the competence *reorganization* processes reported by MADIC (see Figure 24.2), as a model for possible information gathering and actions on the constituent elements of competence (Coulet 2011), as they are described by MADDEC.

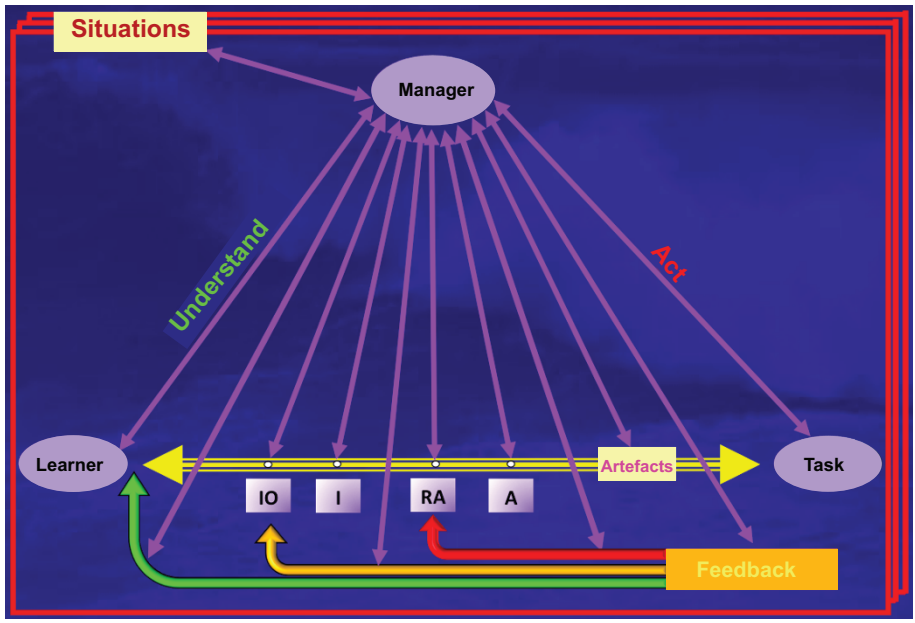

Figure 24.2. *MADIC (French for modèle d'aide au développement individual des compétences, Individual Skills Development Assistance Model)*

8 It can be noted here that it is precisely this role that is assigned to any training whose activity is less about the transmission or transfer of knowledge than about helping learners to construct their own knowledge, through an optimization of their confrontation with this knowledge.

All in all, we see that knowledge can indeed be constructed on the basis of interindividual exchanges, whose processes can be specified at different levels and, on this basis, consider strategic management that promotes these constructions in a virtuous spiral, largely inspired by Nonaka and Takeuchi's (1995) SECI[9] model, in a dialectic of individual and collective skills and source of innovations (see Figure 24.3).

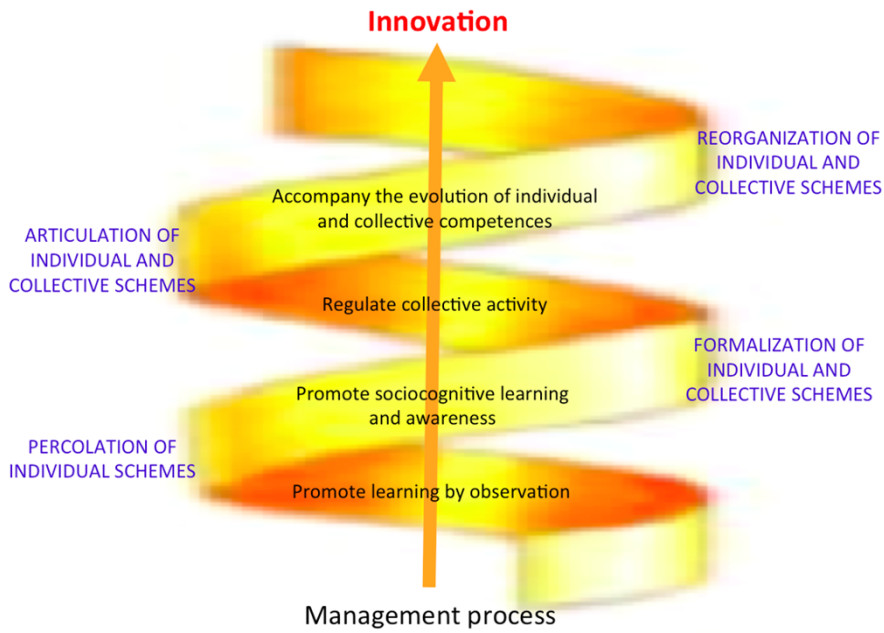
Innovation
REORGANIZATION OF INDIVIDUAL AND COLLECTIVE SCHEMES
Accompany the evolution of individual and collective competences
ARTICULATION OF INDIVIDUAL AND COLLECTIVE SCHEMES
Regulate collective activity
FORMALIZATION OF INDIVIDUAL AND COLLECTIVE SCHEMES
Promote sociocognitive learning and awareness
PERCOLATION OF INDIVIDUAL SCHEMES
Promote learning by observation
Management process

Figure 24.3. *Strategic management model (Coulet 2014)*

24.5. Conclusion

The fact that human cognition necessarily refers to exchanges involving individuals and collectives, the expression "transfer of knowledge" is likely to contribute to masking the essential processes at stake in the articulation of individual and collective skills at the heart of this cognition. The distinction between individual knowledge and collectively validated knowledge leads to a demonstration that these processes, involved at each of these two levels, are not of the same nature and deserve to be explained. From our point of view, in connection with the main

9 SECI meaning: socialization, externalization, combination, internalization.

contributions of developmental and learning psychology, activity theories are therefore very useful in doing so and contribute to better situating the problem of cognition and innovation in the strategic management of organizations and territories. To include the management of "extreme situations" in this logic therefore implies taking seriously that any human activity is both productive of a result and constructive of its own reorganization. Organizational ambidexterity therefore presupposes to be seen in terms of stimulating this permanent skills dynamic, in which knowledge develops in close interaction, but according to very different processes, the command of which certainly represents a significant challenge, especially when it comes to facing an "evolving, uncertain and risky context".

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25

Expeditions as a Legitimate Object in Management Sciences

25.1. Introduction

In recent years, there has been growing interest in the study of expeditions in management sciences (Aubry and Lièvre 2011). Several research groups are working on this issue. For example, the work of the *Centre de recherche clermontois en gestion et management sur les expéditions polaires* (Université Clermont Auvergne and Groupe ESC Clermont), the ESG-UQAM chair for project management, which focuses on expeditions in general and the Swedish research group on extreme environments, and Triple.ED from the École de gestion et d'économie at the Université d'UMEA, which carries out work on commercial expeditions to Everest, to name a few.

This goes hand in hand with the growing popularity of this type of activity. Previously carried out on a voluntary basis and considered the pinnacle of national pride, expeditions have become the tourism industry's new windfall. Among other things, mountain expeditions are a sector of the tourism industry with social, political, economic and environmental impacts (Roberts 2011). For example, in 2012, the adventure industry, in which mountain expeditions constitute a large part, was estimated at around US$263 billion worldwide (ATTA 2010). This has contributed to the emergence of a financial ecosystem involving governments, manufacturers, insurance companies, organizers and the media whose – interdependence is increasingly complex.

The reasoning of researchers who decide to focus on this type of activity is generally as follows: since expeditions that are generally associated with extreme

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contexts (Bouty *et al.* 2012; Hällgren, Rouleau, de Rond 2018) require rapid adaptation and present many uncertainties, it is a field of research that can allow management models to be reinvented, whether in terms of planning, leadership or decision making. This is how we envisioned Darwin's *Un rêve* expedition (Musca *et al.* 2009). Thus, the argument we had developed in a text presented to EGOS (European Group for Organizational Studies) prior to the expedition was as follows: given the geographical difficulties and unpredictable weather conditions, each decision regarding the itinerary, technical choices, risk assessment can put expedition members in a risky situation, which increases the uncertainty and ambiguity faced by leaders in such a situation. This made the Darwin expedition a relevant field of research to study "leadership in a high-risk and ambiguous context" (Musca *et al.* 2009). And as Yin (2003) would say, this expedition was a revealing case offering multiple possibilities to observe leardership *in vivo* in such a context.

Once the data have been collected, meeting the requirements of peer-reviewed publication is another adventure. Although the quantity and quality of data collected far exceeds what can be expected from traditional research in organized contexts, it has been and still is difficult to disseminate them in high-quality publishing spaces. Why? In other words, are expeditions a legitimate object in management sciences? What is this legitimacy made of? And what makes it stronger or weaker?

These are the questions I want to explore in this chapter. I will try to demonstrate that despite the many calls to renew management research fields (Bamberger and Pratt 2010), expeditions struggle to have a legitimate subject status, that is, to be recognized as a valid and appropriate subject to advance our knowledge of organizations. Although expeditions are undoubtedly organized action and constitute a case of temporary organization (Hällgren 2010), these research fields more or less correspond to the largely institutionalized standards of management knowledge production.

This chapter is divided into three parts. First, it discusses the metaphor of the expedition as a source of practical management knowledge. Then, it analyzes how researchers construct their contributions to expedition research. Finally, it discusses the challenges facing researchers interested in expeditions.

25.2. Expeditions as "legitimate objects"?

The work on expeditions is all the rage when it comes to addressing an audience of managers and reporting on management lessons. Indeed, the metaphor of the "mountain" is extremely promising and legitimate in this context. It refers to all the efforts that the manager, contractor or leader must make to "reach the top", by being loaded with luggage (debts, concerns, etc.), and by being responsible for others who have agreed to follow them (employees, colleagues and stakeholders). In addition,

the expeditions offer knowledge based on an "adventure story" that attracts the attention of practitioners much more than would a real case in a sector of activity that would be unknown to them. This may explain in part why the Everest episode in May 1996 gave rise to several case studies that were used to facilitate workshops and seminars in business schools to identify "lessons" to be learned from this experience. It is because the adventure story connects the "cognitive, emotional and experiential" in learning. In addition, the knowledge that emerges is "useful", that is, it refers directly to explicit management themes (decision, leadership, teamwork, project, etc.) and not to gaps in the literature (Hambrick 2005).

All this is also true when it comes to scientific presentations that are made from expedition research. In this case, it is the richness of the context, the commitment of the researchers and the originality of the subject that make it possible to "sell" the argument to the audience. During scientific presentations, the expedition becomes practically an "object of desire". As an empirical case, all agree that the expedition represents a "total social situation" in the Gofmanian sense of the term. The fact that the researcher presenting the data generally participated in the expedition also contributes to "heroicizing" it since it is an unconventional field of research. This goes hand in hand with originality, which is widely valued both in learned societies and in the contemporary world in general. However, when it comes to works intended to produce knowledge in peer-reviewed journals, expeditions appear to be a less legitimate subject or at least one of legitimacy that must be constructed.

What is meant by a "legitimate management purpose"? To use Suchman's (1995) definition of legitimacy, to be legitimate in management, expeditions as research objects must be widely recognized as "desirable and appropriate" in the "system of norms, values and beliefs" related to publication. First, the standards of scientific publication concern the construction of the subject itself. This subject must make it possible to produce knowledge that can be generalized to other types of organizational situations that are not expeditions (Halkier 2011). Second, a peer-reviewed scientific publication is based on values of "rigor" that are generally demonstrated in the way data are collected and analyzed (Gioia *et al.* 2013). Finally, the belief system of the peer-reviewed publication is based on the "relevance" of the theoretical contributions, i.e. their originality and usefulness (Corley and Gioia 2011). In short, to be a legitimate object in management science, knowledge produced from expeditions must be generalizable, rigorous and relevant. This is what is "desirable and appropriate" in high-level scientific publications. Let us take a closer look at this.

25.3 Generalization, rigor and relevance in articles in peer-reviewed journals dealing with expeditions

First of all, it must be said that there are few articles in management peer-reviewed journals that focus on expeditions. I had trouble finding more than a dozen. Of course, they abound in the fields of tourism, geography and social sciences. A first observation, even if it is self-evident, these articles, whose empirical purpose is expeditions, are all of a qualitative nature. At first glance, one might think that this is a handicap for publication in high-level papers. However, it must be understood that papers that build knowledge that advances theories rather than replicating research in other empirical contexts are generally based on qualitative studies (Huy 2012). A second observation is needed: there are the articles on Everest and other general articles. Those on Everest are generally published in high-caliber journals (*Human Relations, Organization Studies, California Management Review*), whereas those on lesser-known expeditions are published in niche journals or are less valued in the academic system. As Elmes and Frame (2008, p. 215) evoke, there is something of the order of "myth" and "spectacle" when it comes to Everest that reflects on those who are interested in it.

That said, the majority of these articles, regardless of journal type, adopt the dominant model of managerial knowledge production. They target a problem in a management field, report on the events of the expedition analyzed and suggest some managerial lessons or at best propose an extension of concepts related to existing managerial literature. For example, Roberto (2002) examines the chain of decisions that led to the Everest disaster in 1996 and concluded that the absence of discussion about mistakes can blind leaders to the choices they make (Roberto 2002). Kayes (2004) examined the same case and identified three factors that explain learning failures in teams: narrow objectives, directional leadership and not realizing that the problem you are facing has been poorly defined. For their part, Allard-Poesi and Giordano (2015) innovate by conducting an analysis of conversations between expedition leaders (Broad Peak and Everest via Northern Ridge) and weather specialists, from which they demonstrate the existence of two distributed leadership configurations (coordinated and collaborative). Then they claim that these two configurations coexist in the same expedition, one not replacing the other. Although the contributions here are not in the order of managerial lessons, they nevertheless contribute to the construction of a discourse on a managerial function, namely leadership. Surprisingly, the genre of published work on expeditions is not very far removed from pedagogical discourse, with the difference that instead of providing management lessons, the articles attempt to target gaps in management theories and knowledge. But is this enough to be a legitimate object of high-level scientific publication?

Generalization refers to how the results can be applied to other situations or are transferable to different or even broader organizational contexts. However, Quy (2012, p. 283) tells us that one of the conditions for qualitative research to be of interest to major journals is that the phenomenon under study must be "little known", that is, it explores an organizational dynamic that has not yet been studied. For example, Tempest *et al*. (2007) in an article published in *Human Relations* proposed to theorize the limits of organization and the "liminality" of individuals who work there when they face extreme conditions. Here, the death zone is used in a metaphorical sense and represents a case that explains the nature of liminal work, i.e. work that occurs at a "border" when the individual is between spaces. It is therefore not decision-making, leadership or project dynamics that are tested in the explanation, but the nature of organizations and work in the 21st Century. In this way, the extent of generalization goes far beyond management and leads reflection directly into organizational theories. This is also the case with Whiteman and Cooper's (2011) paper, which proposes the notion of "ecological sensemaking" developed from an ethnographic study of Cree hunting practices in Northern Canada, rather than describing how they are organized and managed by tribal leaders.

These "little-known" organizational dynamics resonate with issues that go beyond those of expeditions. The reader, more explicitly the evaluator of the manuscript proposed for review, must be convinced that the dynamics explored and described are found in other organizational situations. To answer the generalization argument, it is not enough to say that the conceptual developments and research results are inherent in the empirical object being studied, as Alvarez *et al*. (2011) do when they maintain that the escalating commitment they have observed is based on conditions that are intrinsic to a "project". To make the expedition a legitimate object for high-level management journals, this object must make it possible to explore a "little-known" organizational dynamic that resonates in contemporary organizations.

Although there is no unanimity on what constitutes the rigor of an article, it is generally associated with the accuracy and thoroughness with which the research is conducted and therefore concerns both the strategy and the research design as well as the collection and analysis of data. In articles on expeditions, it is not uncommon to justify the choice of this field of research by saying that non-traditional cases can offer a new perspective on an already known phenomenon (Alvarez *et al.* 2011). However, a majority of these papers are based on research systems that remain traditional in the sense that they are based on archive data or retrospective data. This is particularly true of the work around Everest. As mentioned above, this work has, at the very least, received more recognition in high-level publications than those that offer *in vivo* methodologies. However, Rix-Lièvre and Lièvre (2010) have proposed an innovative methodological system involving the collection of visual data by video-recording for expeditions.

In fact, it is less the problem of data collection than that of data analysis that is used to assess the rigor of research for publication in high-level journals. However, when one looks closely at how the data were analyzed in articles on expeditions, the description of the procedure remains vague and undeveloped. Surprisingly, research that mentions visual data collection rarely proposes a specific procedure for analyzing this type of data. When the authors have participated in the expedition or are familiar with this world, it is not uncommon for them to insist that this knowledge has been used in the data analysis process (Kayes 2004). Some recent work has also been innovative in that it has carried out an in-depth analysis of some of the material collected using discursive analysis methods (example of a conversation analysis of messages exchanged between leaders and meteorologists on two expeditions (Allard-Poesi and Giordano 2015); analysis of the 2-day "acts of speech" and the expedition's "logbook" (Musca *et al.* 2014; Musca *et al.* 2018).

To exemplify the rigor of data analysis, Whiteman and Cooper's 2011 article in the *Academy of Management Journal* is a success story; although it does not present itself as an expedition as such, this can be considered to be the case. From the outset, the authors specify that data analysis is based on the anchored theory method and is the result of an iterative process between data collection and analysis that involves no less than seven steps: (1) description of the ethnographic approach; (2) writing a narrative from ethnographic notes; (3) first phase of coding the ethnographic data; (4) return to the literature (identifying emerging themes by reflexivity); (5) conducting a second study (return to the Mann Gulch disaster and coding the initial narrative); (6) comparison of the two case studies (incidents and actors' roles) and conceptual coding to find out why and how things happened in this way; (7) description of the various steps in data validation. What is both remarkable and surprising in this paper is the balance between creativity and conventionalism, and even between the use of personal experience in sensemaking (case 1, ethnography and shadowing in Cree hunting woods) and objectified experience in an authoritative case study (Mann Gulch). Innovation and rigor are, therefore, rhetorically combined in a harmonious way.

With regard to the relevance of the contributions, i.e. their originality and usefulness, it will not be surprising to note that they have so far been more focused either on empirical contributions (for example we look at leadership in a specific context that has been little studied, but which is representative of temporary or project-based organizations) or contributions dedicated to practice (as previously discussed around lessons or managerial implications). But what is a theoretical contribution in the sense of high-level management reviews? Although they deplore the fact that the knowledge produced in high-level journals gives little importance to practical implications, Corley and Gioia (2011) note that theoretical contributions are generally intended to advance a scientific conversation or redirect it to a new conversation and that, therefore, their usefulness or even relevance depends on their

ability to advance knowledge. In other words, the knowledge produced from expeditions must be used to respond to gaps or gaps in the literature, as the term is used.

This requirement means that researchers must situate their article in current scientific conversations, rather than recount what they have seen or learned that is relevant to the expeditions they have observed and/or analyzed, or locate their research results in managerial issues such as leadership, decision making or project management, to name a few. For example, several studies have been conducted on project management and temporary organizations (see the 2010 special edition in *Journal of Project Management*, edited by Pascal Lièvre and Monique Aubry). This work could, therefore, logically involve conversations about the temporality and/or spatiality found in organizational studies. If we situate expeditions within the tourism and adventure industry, they offer multiple avenues to contribute to institutional theories. They can also contribute to our understanding of different types of "work", whether it is identity, emotional or even managerial. Expeditions can also serve as empirical objects to advance conversations about discourse, sociomateriality, routines, paradoxes and, of course, knowledge, which are key themes found in high-level journals. It is therefore necessary to be at this level of academic conversations to establish the order of our contributions in order to ensure that our work appears relevant and therefore legitimate in the eyes of those who play the role of "gatekeepers" in major academic journals.

25.4. Challenges of producing "legitimate" knowledge from the expedition as an empirical object

The previous section was used to show that expeditions, to appear legitimate in high-level journals, should produce knowledge that (1) illustrates new dynamics that are likely to occur in different organizational contexts; (2) is based on methodologies that are both innovative, widely recognized and accepted; (3) situates their contributions by focusing on developmental conversations in organizational theories rather than those that are central to management. This is what is desirable and appropriate and, therefore, appears legitimate in high-level scientific publications. Meeting these criteria poses a set of challenges for researchers interested in expeditions of all kinds.

First, the researcher whose own research concerns expeditions faces the need to create a knowledge subject that is "de-contextualized" when they are largely convinced that it is the context that constitutes the specificity and originality of their work. And this researcher is quite right, the "expedition world" is a world in itself. Giordano and Musca (2012) also argue that the "inexperienced" or unfamiliar researcher may miss out on what is happening in this world. However, it is less the

knowledge of this world that is at stake in a high-level article than an organizational dynamic that cuts across different types of worlds. It is, therefore, necessary that the researcher agrees to move away from their empirical subject to place it in the background of their argument.

Second, the difficulty of distancing oneself from the field and choosing the "right" story to tell is also a major challenge that is concurrent with the one just stated. However, this challenge is more about the researcher's subjective involvement in the context being studied. When they have followed an expedition closely or indirectly, they have generally lived a strong experience, outside their daily life and often at odds with what they know. Moreover, the knowledge they have is, as Lièvre (2014) would say, rather "experiential". However, experiential knowledge is more easily transferable into actionable knowledge than into scientific knowledge. This partly explains the greater legitimacy of expeditions in terms of management pedagogy. In addition, the researcher's involvement in the context complicates the task of "seeing clearly" or "seeing between the lines" in order to isolate a little-known phenomenon that would be beneficial in the context of publishing a journal that we like to call "academic". In terms of the whole situation, expeditions can be used to document different phenomena other than the expedition itself. And we must be able, or rather accept, is to make an "interpretation" different from what we have experienced in the research process when it comes to translating experiential knowledge into academic knowledge.

Finally, the researcher also faces the challenge of the movement and ambiguity of the boundary between academic production and the adventure inherited from the natural and social sciences. Management knowledge is developed by borrowing from the social sciences. However, many of these subjects have experienced their first developments through the exploration of different worlds that can be associated with expeditions from another time. For example, part of the geography has developed from explorations in little-known landscapes. This is also the case with the first anthropological studies that were conducted in distant lands. At that time, there was no boundary between scientific or scholarly discovery and exploration and adventure. These "scientific travellers" (Couper and Ansell 2012) were legitimate while the knowledge they produced was partly related to the adventure or physical experience they had experienced. Although there are still expeditions that are organized to better understand animal life, environmental conditions, etc., they tend to no longer recognize this physical experience of travel as part of the knowledge process. There is now a more or less moving and ambiguous boundary between scientific discovery and adventure. In fact, for expeditions to be recognized as a legitimate object of knowledge production, it would have to be recognized that the production of knowledge is related to the researcher's physical experience or, in other words, that we cannot know outside our body and outside a context. This is an argument that is far from being unanimously accepted in high-level journals. To do

this, we must "play on rhetoric" as Whiteman and Cooper (2011) did in their article, on the movement, and ambiguity of the boundary between physical and constructed knowledge, between experiential knowledge and scientific knowledge.

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Conclusion

C.1. Toward a dialogue with extremists! (Gilles Garel)

I am not an "extremist", i.e., I am not an extreme expert. Even if had the incredible (extreme?) chance to participate in a polar expedition in 2007 experiencing exploration alongside Pascal Lièvre (as expedition leader), Géraldine Rix-Lièvre and Pascal Croset and to analyze this experience *a posteriori* (Garel and Lièvre 2010), my use of the word "extreme" remains mainly comparable and metaphorical. Cerisy's fruitful long discussion time allowed "non-extremists" to meet and confront "extremists". As a result, we discovered, in reading this book, contributions from reflexive experts, researchers or practitioners, who have made the extreme a management category with its own properties. The extreme is a regime of action in itself. In this collective book, we discover indirect entries into the extreme. The extreme then becomes the qualifier for situations that were first defined differently, for example, by unusual or disruptive innovation, or by high-risk situations in organizations seeking reliability and control.

From this point of view, the contributions summarized here in terms of organization, group dynamics, knowledge management or meanings have virtues for researchers and practitioners who do not use the term extreme but who are confronted with situations where the contributions of extreme situation management are relevant. In open innovation, the manager of an innovative project facing a logistical challenge will learn more from the preparation of a polar expedition than from previous practices of their own company that will attach them to known knowledge. Finally, the book proposes a beginning by/for the extreme in itself and a diverted beginning. The notion of extremes cannot be diluted in this double approach but becomes contingent on it. In the end, we have both empirical material

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through many cases and also a framework for description and action in extreme situations.

Pascal Lièvre made it clear from the outset by retracing the conference debates: management had different attitudes toward the extreme. He wanted to eliminate it, then to face it and today he wants (in part) to generate it through innovation or by putting teams or partners under constraint (a hidden side of the extreme). In all cases, the extreme management situation is at odds with routine, controlled and familiar situations. Intentional or non-intentional, it is the subject of collective action.

The long history reminds us that management is part of the controlled and finalized mechanisms of collective action that have gradually allowed "lesser extremes". Let us consider the passage of the exploits of the first aviators at the beginning of the 20th Century (from this point of view, the Blériot XI, a small fragile aircraft with which Louis Blériot crossed the Channel in July 1909, embodied both courage and danger) to the repetition of the flights controlled today (for an idea of the order, the year 2017 saw about 37 million flights...). Extreme has become a permanent regime, so it is no longer recognized as such. Pioneers risked their lives by moving into the unknown; the modern world with its technologies and rules masks the achievement by repeating it almost every second. The stages of technological and managerial innovation have contributed to this vigilant adjustment. The book shows us that these lesser extremes are more or less adding up. For highly reliable organizations, the extreme is under control, even for environmental stakeholders. Elsewhere there is encapsulation or isolation of a non-extreme situation in an environment that remains extreme. Thus, the polar is an extreme environment (cold, windy, chiaroscuro) but the situation in a polar environment is not necessarily extreme: with modern equipment, explorers can live comfortably in a tent while a freezing wind blows outside at 120 km/h. Nowadays, before setting off particular care was taken in preparing the expedition. The management of extreme situations (in this control objective) is *ex ante* a definition of the field to which it will apply.

The book also highlights the need for a return to solidarity in the management of extreme situations; the extreme and particularly the dangerous extreme calls for solidarity. In war, the bad leaders repress the mutineers while the good ones prevent mutinies by asserting their authority in concern for the cohesion of the social body. Paulo Grobel gives us a magnificent example of this in his intervention on Himalayan expeditions. Where some expedition leaders put pressure on teams to achieve the feat, Paulo Grobel proposes a "gentle leader" theory that empathetically coordinates a slow progression in the mountains.

The extreme basically highlights management needs in all circumstances, even non-extreme ones. In this respect, it is an excellent pedagogy of management from which we should draw inspiration as teachers. May this book provide material for a wide community of "extremists" and "non-extremists" who want to understand and act, to understand in order to act.

C.2. Learning from extreme situations and from the ethnographic approach (Monique Aubry)

On the wall, photos of great philosophers and writers are admired from afar. This is enough to impress a Quebecker for whom Cerisy-La-Salle represents an exceptional and symbolic place of French intellectualism. Talking about extreme situations in a place like this invites us to think differently. As much as the extreme seems to us to belong to the present, the walls of the castle tell us of the extreme in the centuries of Normandy history: the extreme of war situations. Yet, the same place reconciles, in the same space, quests of very different meanings.

In my mind, there is no doubt about the relevance of exploring the extreme to better understand ordinary management situations. In fact, I am often surprised to see how much practitioners feel concerned and recognize themselves when we tell them a story about a polar expedition. This makes it possible to put words to the extreme experience, it makes it possible to account for difficult situations that otherwise remain unspoken, and therefore invisible.

Pascal Lièvre's Management of Extreme Situations research program, which forms the framework of this book, opens a new path of knowledge on management situations, a new grammar, perhaps. I first became interested in the issue of organic ambidexterity with Pascal (Aubry and Lièvre 2010) based on the analysis of two polar expeditions where the expedition leader had to make a decision, sometimes based on his knowledge, sometimes to explore or sometimes to follow the plan, sometimes not. But in the end, most extreme situations are very tense. This can be seen in this book where ambidexterity is discussed in almost all chapters. For example, Geneviève Musca's chapter (Chapter 17) on the Darwin expedition highlights several tensions in the team, particularly when it comes to making the decision to abandon the boat, leaving everything behind. Another example is Anaïs Gautier's chapter, where the error of reasoning highlights a tension with serious consequences in decision-making.

The Cerisy-La-Salle symposium gave rise to good exchanges on epistemological and methodological perspectives. Here, I refer to Géraldine Rix-Lièvre's chapter (Chapter 6), which distinguishes extreme contexts from extreme situations according to the point of view. The former are presented from the point of view of the

observer, while the latter are presented from the point of view of the person involved in a context that for them appears to be extreme. It is not surprising to find in this second approach ordinary management situations where the extreme is present, particularly in project activities. The very nature of project activities is evolving, uncertain and risky. The project evolves from an idea to the end of the realization. No one can really anticipate how the project will unfold, nor what the situation will be at the end of the project: there is a large amount of uncertainty in the project, especially in innovative or complex ones. This is in addition to the fact that the project involves a number of different types of risks. In short, the project, by its very nature, undeniably has extreme characteristics.

Learning project management from the management of extreme situations is already a major step that this book confirms. But there is a plus. Research conducted in extreme contexts is often based on ethnographies, including those conducted in the Management of Extreme Situations program. Video is widely used. But even more important is the place of the committed and reflexive researcher to approach extreme situations with actors. It seems to me that there is something to be learned from the study of extreme situations and the methodologies used in them. If we recognize that the project is similar to an extreme situation, could we not approach it internally with researchers who are ready to commit themselves fully? It seems to me that there is room for the renewal of epistemological and methodological perspectives inspired by the one put forward in the study of extreme situations.

In short, the objective achieved at Cerisy-La-Salle is to put into perspective a research program on extreme situations that is articulated in several dimensions and to invite researchers and practitioners. They shared their knowledge, their testimonies and their passion. They have pushed the boundaries of the research program further. The book reports on the work accomplished.

And our group photo is added to the other photos on the wall of Cerisy-La-Salle to testify to our sustained work over 7 days.

C.3. The extreme is on the agenda of management sciences in the 21st Century (Pascal Lièvre)

I would like to acknowledge here all the contributors to this book who have made it possible to take a step forward in the development of the research program that we have been conducting since 1999. It is indeed a question of constructing a new kind of management situation: the extreme management situation. As we have stated, it is the new contemporary economic context that has taken the form of a knowledge and creativity economy since the founding work of Drucker and Nonaka, which has led managers to be confronted in a frontal and permanent way with this

new type of situation. This is extreme innovation. But we wanted to show that this extreme innovation can be built on other forms of extremes: extreme risk, extreme urgency and extreme crisis to develop in terms of research. Organizational creativity and organizational reliability can be combined.

It is not the extreme in itself that has been invested in, even if an etymological detour might have been necessary, but the extreme according to different ontologies: practices, events, contexts, situations and organizations. We have proposed a provisional grammar of extreme management situations from the introduction. But there were important distinctions between the contexts and situations according to Géraldine Rix-Lièvre (Chapter 6), and the need according to Benoît Journé to associate the extreme with a situation or an organization (Chapter 11).

The extreme appeared in different forms that we were able to characterize. This is extreme innovation: we have to invent things that are at odds with our technologies and markets. It is the Creaholic organization that has developed an organizational form that Gilles Garel believes will permanently generate a disruptive innovation (Chapter 8). According to Sylvain Lenfle (Chapter 2), it is a new type of project that emerges at the interface of project management and innovation management: exploration projects are characterized by the emergence of objectives and means of which the Manhattan project is emblematic. But it is also a matter of extreme urgency: we must act quickly or things will go wrong. It is the organization of the rescue services that is entirely dedicated to this type of situation and which proposes, for example, to track down errors, according to Anaïs Gautier (Chapter 12). This is the extreme crisis: because the situation is beyond our capacity. It is Ubisoft which, in order to face a new and violent crisis, invents in a situation a way to recombine existing routines according to Patrick Cohendet and Laurent Simon (Chapter 7). There is also an extreme risk: the slightest mistake can have dramatic consequences. Paulo Grobel, in his attempt at technical innovation in the Himalayas, shows how vital risk is present and shapes the way people organize themselves in high-altitude expeditions (Chapter 4). There is the extreme complexity that is characterized by many interconnections between different entities, highlighting links. How then to design an exploration training program in a large industrial group? This is the complex question that Bruno Stévenin and Éric Dépraetere asked themselves (Chapter 3). Finally, extreme ambiguity arises when a variety of interpretations of the situation are expressed. Geneviève Musca, in collaboration with Caroline Mellet, Gilda Simoni, Frédérique Sitri, Sarah de Vogüé and Linda Rouleau, explained how climbers try to interpret a situation where a radical change of plan gradually appears as a necessity, in this expedition to conquer the Darwin mountain range (Chapter 17). These distinctions between these different categories of extremes should not mask the many possibilities of combining them.

In the end, we have been led to characterize the extreme management situation by a subjective and objective break with a more familiar previous situation (evolutionary) towards a situation where the new radically unpredictable situation cannot be ruled out (uncertainty) and where actions are never insignificant. They can have serious consequences on the economic, organizational, vital or symbolic level (risk). The extreme situation may be experienced or desired depending on the degree of freedom that the actors have with regard to the situation (Rivolier), standard or project-based depending on the existence or not of organizational routines to deal with the situation. An event can make the situation an emergency by forcing a rapid reaction to avoid an unfortunate outcome (Roux-Dufort, Wybo) and if the situation exceeds the organization's capacities, there is a crisis situation (Roux-Dufort, Wybo). From this framework, a heuristic of extreme situation management was proposed for discussion, placing three registers at the heart of organizational performance: the construction of meaning, organizational ambidexterity and the expansion of knowledge (Lièvre 2016).

The question of meaning construction has been addressed from a variety of perspectives, but also as a way of combining sensemaking and meaning. Jean-Pierre Boutinet showed how the construction of meaning in a project was an interaction of meaning (Chapter 13). Michel Récopé proposed to approach this question of sensitivity as imbued with a vital logic (Chapter 14). The identity and learning itinerary of a sea kayaker in the Arctic, as told by Pascal Croset, was a beautiful way to illustrate this reflection (Chapter 15). Monique Aubry showed how organic ambidexterity at the team level appeared first compared to organizational ambidexterity (Chapter 16). But behind this necessary ambidextrous nature lies a complexity when changing plans while within the situation, as Geneviève Musca explains in collaboration with Caroline Mellet, Gilda Simoni, Frédérique Sitri, Sarah de Vogüé and Linda Rouleau (Chapter 17). The notions of "spark", "manifesto" and "community" developed by Patrick Cohendet have been proposed on several occasions as a chronological reading grid for knowledge expansion mechanisms. Social networks with Marc Lecoutre (Chapter 20), communities with Jean-Philippe Bootz and Olivier Dupouët (Chapter 19), the crowd with Claude Guittard and Éric Schenk (Chapter 21) have emerged as social configurations that could fully participate in knowledge expansion processes. Jean-Louis Ermine and Pierre Saulais also showed that we can mobilize the assets of knowledge to produce the expansion of knowledge (Chapter 18). This question of knowledge expansion borders the highly structured theoretical framework of the field of psychology. Bridges are emerging with management sciences, as Guy Parmentier has developed around organizational creativity (Chapter 9). Todd Lubart and Samira Bourgeois-Bougrine mentioned the consubstantial proximity between creativity and extreme situations, and the state of a substantial literature on the subject (Chapter 10). It was naively thought that the extreme situation could be a constraint for creativity when it is a breeding-ground for choice. Jean-Claude Coulet showed the possibilities of a

coupling between management sciences and the theories of learning and development specific to the field of psychology (Chapter 24).

The variety of terrains of extreme situations has been explained: the release of power to act together in a coworking space with Christelle Baron, the complexity of implementing a freedom of discourse in a bank with Isabelle Magne, rules of the game of an Open Lab understood as an epistemic community with Nicolas Laroche, critical knowledge of equity portfolio managers with Stéphane Cellier-Courtil and practice in knowledge expansion in a simulation project of a team on Mars with Emmanuel Bonnet (Chapter 23). The cultural and artistic sector has emerged as a particularly fertile ground for managing extreme situations, as David Massé has demonstrated (Chapter 22).

Finally, we reaffirmed on a methodological level the need to invest in actors' processes in situations and to fully mobilize the field of anthropology, which is capable of proposing some epistemological guidelines for reflexivity under the work of Mondher Kilani (Chapter 5). Géraldine Rix-Lièvre in the same vein wanted to highlight the relevance of the use of video in ethnographic practice (Chapter 6).

Climate risk, disruptive innovation, the migration crisis, technological risk, financial crisis and the permanent emergency situation: extremes are increasingly being invited into our societies, economies and organizations. In other words, extreme management is now on the agenda of research in management sciences at the beginning of the 21st Century.

This Cerisy symposium, and this book from which it comes, make it possible to show that today there is research work of a great quality and a great variety around the extreme. There is even an international French-speaking community in management sciences around this subject[1]. Even if we have been able to measure the progress made in this area but also to become aware of the road ahead, such is the need for clarification and capitalization, as Hällgren *et al*. (2018) highlight, in order to take a new step forward in the development of research into extreme management. Linda Rouleau proposed the keys to good academic practice to access internationally authoritative journals (Chapter 25).

Two lively questions emerged at the end of our debates. Extreme situations as a breaking point force actors in situations to learn. Thus a first question arose: but under what conditions do the actors learn together in a situation? Work on situated learning (Lave and Wenger 1991; Wenger 1998) seems to be structuring because of

1 A community that has gathered several times: in 2010 in Montreal at ESG-UQAM, in 2016 in Cerisy-La-Salle and in 2018 in Clermont-Ferrand at IAE as part of the Entretiens Jacques Cartier.

the focus it has on combinations between different processes around an ongoing activity: construction of meaning, identity construction and socialization. Situational learning is not something trivial but rather a complex social construction that constitutes an essential prerequisite for the development of this type of collective action. We can find ourselves in an impossible learning situation. Second, the question of organizational routines in the articulation of their ostensive and performative dimension (Feldman and Pentland 2003, 2005) is part of this learning, as Patrick Cohendet and Laurent Simon have shown, according to two meanings: (1) extreme situations force actors to create organizational routines to cope with the progress of collective action; (2) but in the same way the question of the gap between the organizational routines owned by the actors and those necessary for the situation arises as a recurring obstacle to the performance of collective action, when this gap is too large. We may then be faced with an impossible mission.

Extreme management appears as a managerial breakthrough that forces us to work with the unknown, scalability, uncertainty and risk, a fascinating management research program in perspective for the 21st Century.

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